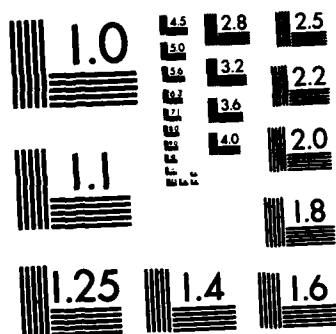


OLDER WORKERS IN THE MARKET FOR PART-TIME EMPLOYMENT  
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PROFESSIONAL PAPER 397 / September 1983

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# APPENDICES TO PP 396: OLDER WORKERS IN THE MARKET FOR PART-TIME EMPLOYMENT

James M. Jondrow  
Frank Brechling  
Alan Marcus

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*This report contains*

**APPENDICES TO PP 396:  
OLDER WORKERS IN THE  
MARKET FOR PART-TIME  
EMPLOYMENT.**

*Contents includes:*

James M. Jondrow  
Frank Brechling  
Alan Marcus

*A general equilibrium theory of hours  
and compensation per hour;*

*Evidence of the part-time penalty;*

*An empirical inquiry into the  
relationship between hours worked  
and compensation;*

*Policy analysis; and*

*The age compensation of different  
industries.*



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## Appendix A

### A GENERAL EQUILIBRIUM THEORY OF HOURS AND COMPENSATION PER HOUR

The determination of hours of work is presented usually as the outcome of suppliers' or demanders' decisions but only rarely as the outcome of demand and supply interaction in the labor market. Thus, suppliers of labor are assumed to choose optimum levels of hours by maximizing their utility subject to exogenously given fringe benefits and (post-tax) wage rates. Further, demanders of labor typically choose their optimum hours by maximizing profits (or minimizing costs) subject to exogenously given fixed labor costs, hourly wage rates and overtime premiums.

A good example of analysis on the demand side is Ehrenberg's 1971 book on overtime behavior. Here the employer's demand for overtime is related to factors such as the ratio of fixed to variable costs. Empirically, fixed costs are taken as nonwage compensation such as pension contributions along with social insurance contributions.

The Ehrenberg analysis is explicitly based on a short-term, disequilibrium framework, in which workers will supply as much overtime as demanded at a given wage. The assumption is that either there is a chronic excess supply of overtime (the overtime premium is, by law, set too high), or there is a short-term agreement existing between employer and employee that fixes the wage and lets the employer decide hours.

One obvious way to analyze part-time work is to reverse the Ehrenberg analysis to explain "undertime." We did not do this. The reason is that the disequilibrium framework appropriate for a temporary phenomenon such as overtime behavior is not at all appropriate for

permanent, part-time work. Instead, we adopt an approach based on the interaction of market forces: Entry (and exit) ensure that supernormal profits are eliminated so that the typical firm's net output is entirely exhausted by factor payments.

The theory draws heavily on the theory of hedonic prices and implicit markets, as described by Sherwin Rosen. Under this theory, products of different characteristics will sell at different prices, the price differences measure the implicit prices of the different characteristics. The implicit price of a characteristic is determined by the interaction of supply and demand, so it represents both the marginal value and the marginal cost of the characteristic. In the present case, the characteristic is hours per worker. Workers with different hours per week have different characteristics. Hence, they will not be paid at the same hourly rate. In the following, we describe how this hourly pay and equilibrium hours are determined in a general equilibrium context.

Our particular application of Sherwin Rosen's hedonic framework draws on a number of earlier works. H. Gregg Lewis analyzed the employer's demand for longer hours--to economize on fixed cost. Y. Barzel provides a graphical analysis in which there is an equilibrium spectrum of hours and rates of pay. Finally, H. Rosen presents an empirical model in which an hours rate of pay locus forms the budget constraint for labor supply.

### The Theory

Let the production function of a typical firm be  $C = M \cdot g(h)$  where  $C$  stands for net output, measured in units of consumer goods,  $M$  for the number of employees and  $h$  for the average hours worked. For the sake of simplicity, other factors of production have been ignored. The production function has constant returns in  $M$ , so that it can be written as  $c = g(h)$  where  $c$  stands for output per employee. The  $g(h)$  function is assumed to have a positive first derivative throughout its relevant range. The second derivative is likely to be positive at low levels and negative at high levels of  $h$ . The  $g(h)$  function shown in figure A-1 has these properties.

The typical worker's utility function can be written as  $u(c, h)$  where the marginal utility of  $c$  is positive and falling with  $c$ , while the marginal utility of  $h$  is negative and falling with  $h$ . Such a utility function implies upward sloping convex indifference curves, as illustrated in figure A-1 by the line labeled I.

It should be pointed out that  $c$  measures the compensation per employee when  $h$  hours are being worked. The average hourly compensation is  $c/h$ , which in general is not equal to the slope of the production function at  $h$ , namely,  $g'(h)$ . Typically,  $c$  is paid to the worker as a combination of fringe benefits and hourly wages. Note that we are assuming that fringes and wages are of equal value to the employee.

Since competition and free entry ensure that the entire net output ( $c$ ) is paid to labor, the  $g(h)$  function is the available choice set for



the typical worker. His or her utility is maximized where an indifference curve is tangential to the  $g(h)$  curve. In figure A-1,  $h^*$  represents a point of maximum utility.

Formally the utility maximization problem can be stated as:  
Maximize  $u(c, h)$  subject to  $c = g(h)$ . The first-order condition for this problem is

$$\left. \frac{dc}{dh} \right|_{u=\bar{u}} = -g'(h^*) .$$

Let us now extend the above theoretical framework by allowing for heterogeneous tastes and technologies and for fixed costs.

1. Heterogeneous tastes. It is relatively easy to let workers with different tastes coexist in the above model. In figure A-2, let  $I_1$  and  $I_2$  refer to two workers with a relatively strong preference for income and leisure, respectively. The slope of the ray through the origin indicates that the average hourly compensation is lower for the part-time than the full-time worker. (Note again that the ray need not be tangent to the production function. The slope of the ray is the employee's average, not his marginal compensation per hour.)

2. Nonremunerative (NR) costs.\* Some costs are incurred by employers or employees, but are not received by the other partner to the bargain. Specifically, let us consider: (i) the time it takes employees to travel to and from work ( $\bar{h}$ ); (ii) the dollar cost to employees of having the job ( $R$ ), such as the cost of work clothes, child

\* Note that differences across employees in the valuation of fringes and cash can be treated in the same way, e.g., the  $g(h)$  function can be horizontally or vertically displaced to account for these differences.

Fig. A-1. Optimum Hours and Compensation.

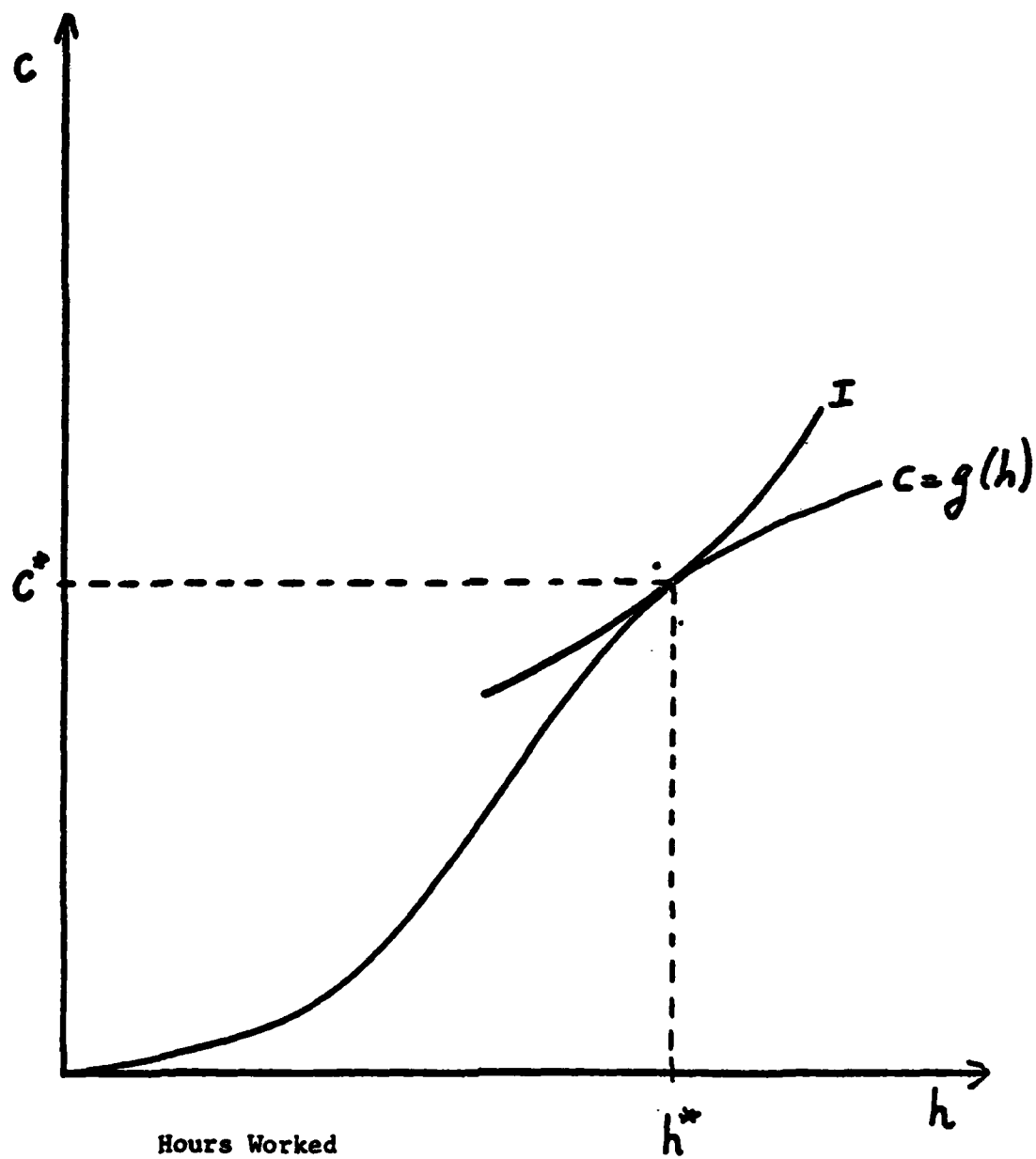
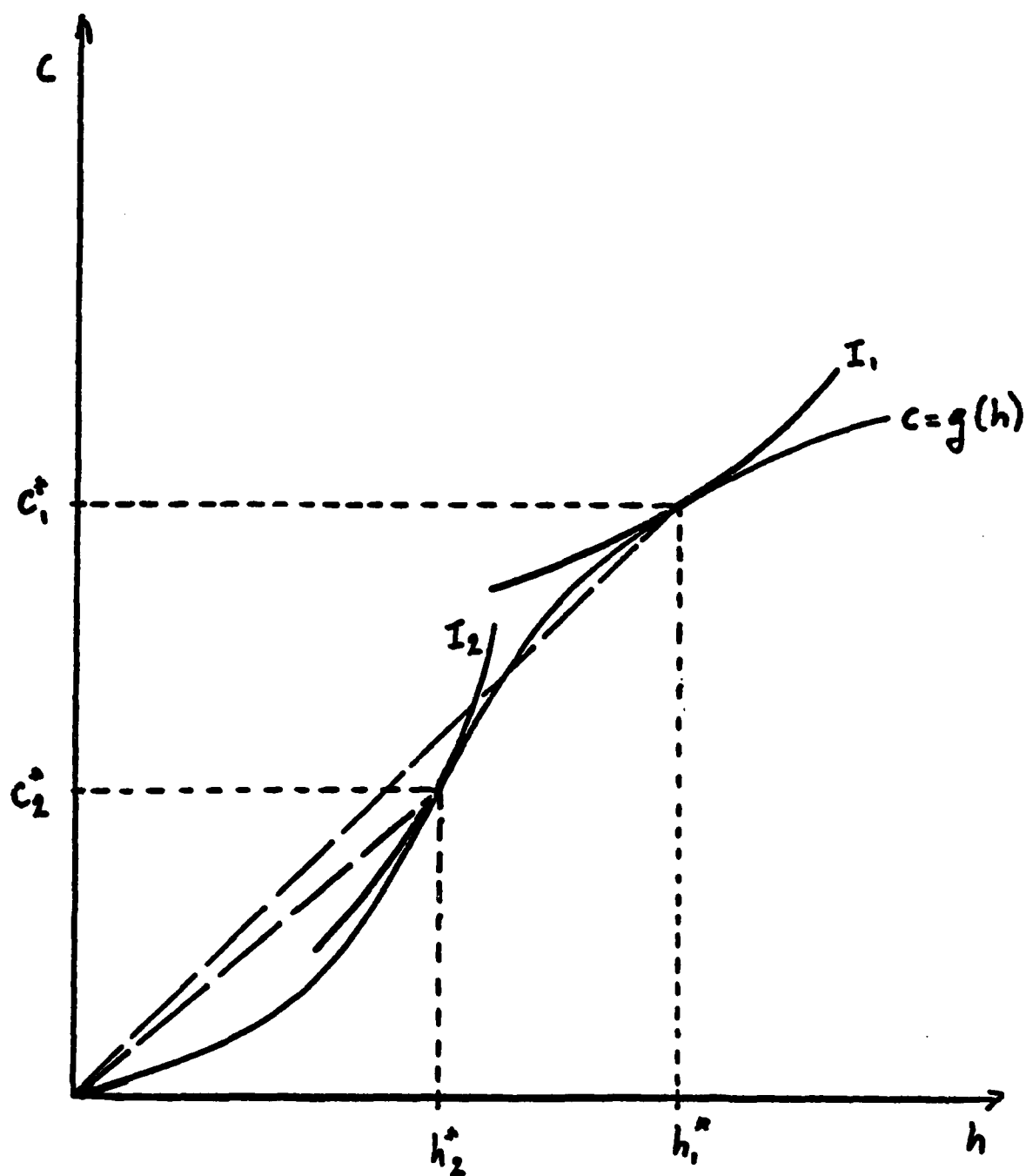


Fig. A-2. Heterogeneous Tastes.



care, and transportation; and (iii) dollar costs to employers (T), such as training costs, social insurance contributions, etc. The effects of these costs are illustrated in figure A-3. The existence of  $\bar{h}$  means that the compensation curve lies to the right of  $g(h)$  by  $\bar{h}$ . The NR costs  $(T + R)$  shifts the compensation function down from  $g(h + \bar{h})$  to  $g(h + \bar{h}) - (T + R)$ . Thus, the time and dollar costs reduce the net output and, hence, the total compensation per employee.

Three important implications of NR costs should be emphasized. First, the downward shift of the  $g(h)$  function is essentially an income effect. When leisure is a normal good, this effect leads to an increase in hours worked. In figure A-3,  $\bar{h}$  leads to a movement from A to B and T and R lead to a function shift to C. Second, the costs reduce the worker's average hourly compensation by more for part-time than for full-time workers. Suppose, for instance, that NR costs amount to \$8 per day. This means that net compensation has to fall by \$1 per hour for workers working eight hours, but it must fall by \$2 per hour for workers working only four hours. Thus, the penalty increases as hours worked per week decrease. As is illustrated in figure A-4, the existence of fixed NR costs rules out certain short hours altogether. The net compensation function  $g(h + \bar{h}) - (T + R)$  does not yield positive values when hours fall short of  $h_1$ . Consequently, part-time jobs for  $h < h_1$  would be not available at any positive remuneration, so that the typical employee maximizes his or her utility at  $c - h = 0$ .

NR costs that are fixed costs shift the  $g(h)$  function down without affecting its slope of  $g'(h)$ , so that they have only an income

Fig. A-3. The Effects of Nonremunerative Employment Costs

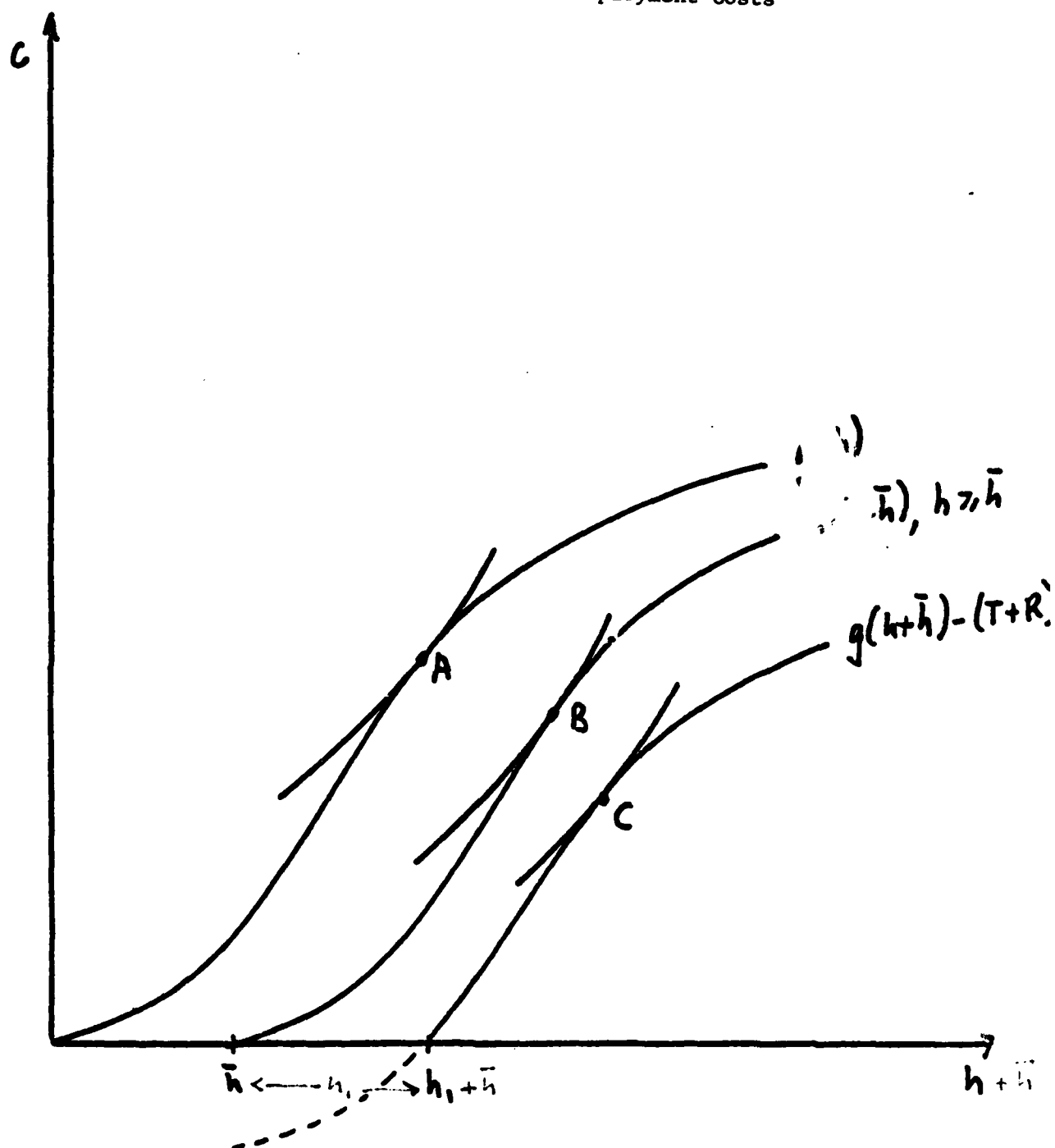
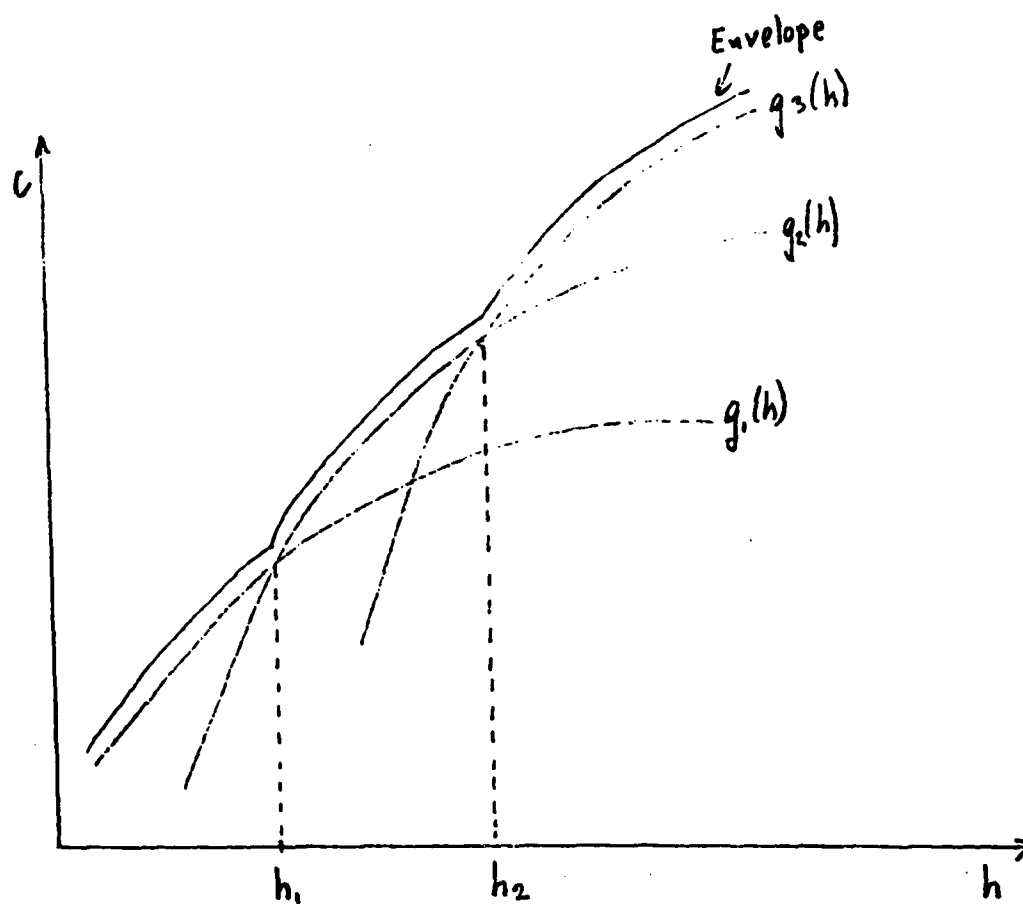


Fig. A-4. Heterogeneous Technologies.



effect. NR costs that vary with  $h$ , would, by contrast, make the function flatter, that is, they would reduce  $g'(h)$ . Consequently, they have both an income and a substitution effect. When leisure is a normal good, the income effect would raise and the substitution effect would reduce the optimal hours worked. The net outcome would be uncertain. Moreover, as long as variable costs do not exceed 100 percent of net output, they do not entirely eliminate low-hour jobs as fixed costs may do. We conclude that, in general, increases in fixed costs are more powerful in raising optimal hours and in eliminating low-hour jobs than are variable costs.

3. Heterogeneous Technologies. Heterogeneous production techniques may also coexist in the theoretical framework presented above. In figure A-4, three different  $g(h)$  functions are illustrated:  $g_1(h)$ ,  $g_2(h)$ , and  $g_3(h)$  yield the highest levels of net compensation ( $c$ ) below  $h_1$ , between  $h_1$  and  $h_2$  and above  $h_2$ , respectively. The relevant aggregate relationship is the envelope of the three functions, which consists of the highest segments of each. The envelope is upward sloping over the relevant range of hours and tends to become flatter at high levels of hours. The effects of fixed costs on the envelope are very similar to those on the individual  $g(h)$  functions. A general increase in fixed costs for all technologies shifts the envelope downward and leads to an increase in hours worked, an increase in the penalty for part-time work, and the elimination of some part-time jobs.

When both heterogeneous tastes and technologies are allowed for, individual workers tend to locate along the envelope. Workers with

relatively high (low) preferences for leisure will go to establishments that are most productive at low (high) hours.

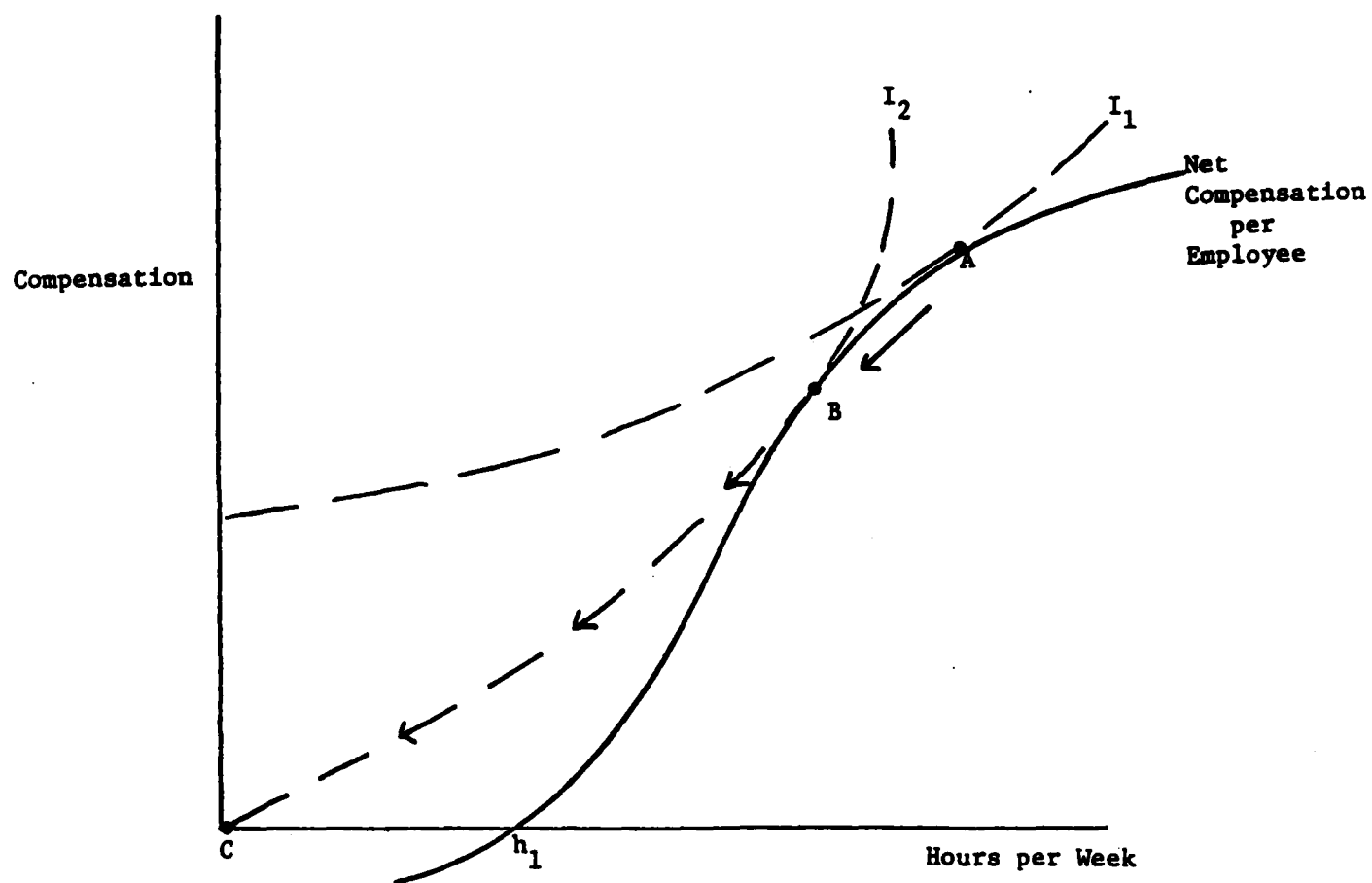
#### THE THEORY OF RETIREMENT

So far, the discussion has been in terms of tangencies and how they change. The explanation for sudden retirement is not a tangency, but a corner solution. Older workers want to retire gradually, but discover that when they try, they can only do so if they accept a lower wage as a part-time penalty. This part-time penalty reinforces their desire to cut down on hours. And, in fact, it reinforces it to the point where it no longer makes any sense to arrange for a job, and they retire completely.

In figure A-5, the desire to retire gradually is represented by a steepening indifference curve, which "begins to move" the tangency to the left along the production function. At some point, the indifference curves steepen enough so that the most preferred curve the worker can reach, the one that is tangent to the production function, also goes through the origin. Now the worker is indifferent between working and quitting. When the steepening increases slightly, he quits suddenly, that is, he moves to the origin. This is our explanation of sudden retirement.



Fig. A-5. The Retirement Decision.



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## Appendix B

### EVIDENCE ON THE PART-TIME PENALTY

One implication of our work is that the wage received by an employee will be positively related to his hours worked. This result has been obtained in previous research. For example, Owen (1978) found that men who work part time earned 30 percent less than full-timers and that women experienced a 17 percent differential, controlling for other characteristics. Rosen's (1976) study of joint wage-hour decisions of married women indicated that wages increase by 2 percent with each additional weekly hour worked. The empirical work presented below estimates the relationship between hourly wages and weekly hours, using more recent data.

We employ data from the Panel Study of Income Dynamics. A cross section was created from the 1979 survey year of the panel. We concentrate on a sample of 3686 married women. Although the data on heads of households is more complete than that for wives, the limited number of part-time workers in the subsample of heads reduces its utility for this line of research.

The objective is to obtain an estimate of the shape of the wage-hours locus. We want to estimate a log-wage regression controlling for weekly hours. This estimation raises several econometric problems that must be addressed, however. First, of the women in the sample, 1660, less than half, were labor-force participants. Since our wage equations were estimated without any correction for this obvious selection

problem, all estimates should be interpreted as conditional on labor force participation.

Second, it is clear that wages and hours are simultaneously determined. If a standard wage regression were estimated, one would expect the coefficient on actual hours to be biased downward. Therefore, separate hour equations are estimated to provide an instrumental variables estimate. This hours instrument is used in place of actual hours in the regressions reported in this section.

A final problem with the estimation of labor force activity of wives results from the joint nature of labor force decisions of couples. The inclusion or exclusion of husband's income in the wives hours or wage equation can significantly alter the empirical results. Larson (1979) notes that the positive coefficient on the hours variables in Rosen's analysis disappears when husband's income is excluded from the wage equation but retained in the hours equation. Preliminary analysis with our data obtained similar results. If marriage results in assortative mating, i.e., able men marry women whose unobserved traits make them more productive--then husband's income may be a good proxy for unobservable ability in the wage equation for wives. Husband's income has a strong negative coefficient in an hours equation. As a result, the hours instrument created from an equation including husband's income will be correlated with the omitted ability proxy if husband's earnings are not included in the wage equation resulting in downward bias on the hours coefficient. The alternative we use in this analysis is to exclude husband's income from both of the equations. Although this provides a less complete model of the labor supply choices of married

women, it gives an unbiased estimate of the wage-hours locus which is our primary concern.

## RESULTS

Table B-1 presents the results of regressions of working wives' hourly wages on a vector of personal characteristics. The coefficients generally behave in a predictable way. The major variables are significant and consistent with previous research. Some results are surprising, however. The union coefficient is quite small and is not significant at conventional levels. Additionally, the coefficient on part-time experience, although negative, is small and insignificant. Taken at face value, this would indicate that the returns to a year of part-time experience are equivalent to those from a year of full-time work. Although this result is difficult to accept, speculation about the causes of this result are left for another time.

The main variable of interest in this equation is the hours instrument. The coefficient on hours is statistically significant and large. An increase of more than 3 percent in the hourly wage results from each additional hour in the standard work week. Since the mean number of hours worked by women in the sample is 35, these results imply that, for the typical woman, reducing weekly hours from 35 to 20 would result in a wage that was only 62 percent as large as her previous wage.

The part-time penalty predicted from these estimates is very substantial and is consistent with the theoretical predictions from our model. Further, it should be remembered that fringe benefits are normally reduced for part-time workers, although it is not clear whether

TABLE B-1. LN HOURLY EARNINGS OF WIVES

| Variable       | Coefficient | Standard Error |
|----------------|-------------|----------------|
| South          | -.162*      | (.042)         |
| Urban          | -.036*      | (.018)         |
| White          | .102*       | (.023)         |
| HSG            | .128*       | (.024)         |
| SCOL           | .296*       | (.030)         |
| GGRD           | .495*       | (.031)         |
| Union          | .069        | (.056)         |
| Age            | -.0006      | (.002)         |
| EXPER          | .025*       | (.004)         |
| EXPER Sq.      | -.0005*     | (.0001)        |
| EXPER PT       | -.001       | (.001)         |
| Tenure         | .0004       | (.004)         |
| # KIDS         | .019        | (.015)         |
| HRS            | .033*       | (.014)         |
| Constant       | .052        |                |
| R <sup>2</sup> | .33         |                |
| N              | 1660        |                |
| lnw            | 1.55        |                |

South, Urban, White, and Union are (0, 1) variables. HSG, SCOL, and CGFD are also dummy variables representing high school graduates, college attendees, and college graduates. EXPER and Tenure are measured in years, with EXPER PT equaling the number of years that were part time. # KIDS indicates the number of children less than 17 year olds, and HRS is the instrumental variable estimate. The regression from which the hours instrument is derived is shown in table B-2.

\* Significant at the 95 percent level.

TABLE B-2. HOURS REGRESSION, WORKING WIVES

| Variable   | Coefficient | Standard Error |
|------------|-------------|----------------|
| South      | 1.598*      | (.575)         |
| Urban      | .433        | (.536)         |
| White      | -.923       | (.610)         |
| HSG        | -.264       | (.706)         |
| SCOL       | .331        | (.909)         |
| CGRD       | -.207       | (.922)         |
| Union      | 3.359*      | (.791)         |
| Age        | .337*       | (.140)         |
| Age Sq     | -.0059*     | (.0018)        |
| Tenure     | .286*       | (.054)         |
| KIDS       | -1.107*     | (.236)         |
| Constant   | 29.747      | --             |
| $R^2$      | .06         |                |
| N          | 1660        |                |
| Hours Mean | 34.6        |                |
| Std. Dev.  | 11.5        |                |

\* Significant at the 95 percent level.

these reductions are more or less than proportional to the wage penalty. The empirical findings indicate that the lack of part-time work observed in the economy is consistent with rational labor supply decisions.

The argument for expecting a part-time wage penalty is based on fixed nonremunerative costs and on marginal productivity increasing with hours of work. If this is the case, then we would expect to see differences in the part-time penalty across industries, as a result of different patterns of cost and technology. Table B-3 compares wage regressions for married women in manufacturing and white-collar nonmanufacturing industries. There are differences in the constant and in the magnitudes of some variables, (the race variable, for example), but the equations look quite similar in most respects. The substantial difference, of interest here, however, is in the size of the hours coefficient. It is three times as large in the nonmanufacturing regressions, indicating a much steeper wage-hours locus in this sector. When industry specific dummies were included in this regression, they were significant, but changed none of the coefficients other than the constant.

This finding lends some support to the argument that wages depend on hours due to the structure of costs and technology, although it is obviously not conclusive. The fact that the wage-hours locus is less steep in manufacturing, where a priori, one could expect higher fixed costs, is surprising, but not contrary to the theory. One explanation for this result may have to do with the presence of overtime. Manufacturing industry employees work an average of 38 hours compared to 33 for those in the nonmanufacturing sample, and thus a higher proportion



TABLE B-3. LN HOURLY EARNINGS OF WIVES BY SECTOR

| Variable      | Manufacturing (SIC 3, 4) |                | Nonmanufacturing (SIC 6,7,8,9) |                |
|---------------|--------------------------|----------------|--------------------------------|----------------|
|               | Coefficient              | Standard Error | Coefficient                    | Standard Error |
| South         | -.207*                   | (.047)         | -.180                          | (.059)         |
| Urban         | -.050                    | (.038)         | -.062                          | (.027)         |
| White         | .038                     | (.045)         | .154                           | (.039)         |
| HSG           | .037                     | (.044)         | .092                           | (.043)         |
| SCOL          | .226*                    | (.072)         | .214                           | (.066)         |
| CGRD          | .470*                    | (.115)         | .436                           | (.054)         |
| Union         | .077                     | (.052)         | .038                           | (.086)         |
| Age           | -.006*                   | (.003)         | .002                           | (.003)         |
| EXPER         | .031*                    | (.010)         | .023                           | (.005)         |
| EXPER SQ      | -.0006*                  | (.0002)        | -.0004                         | (.0001)        |
| EXPER PT      | -.009                    | (.006)         | -.001                          | (.001)         |
| Tenure        | -.001                    | (.005)         | -.001                          | (.006)         |
| # KIDS        | -.028                    | (.016)         | .046                           | (.027)         |
| HRS           | .015                     | (.014)         | .051                           | (.025)         |
| Constant      | 1.025                    | --             | -.061                          | --             |
| $R^2$         | .39                      |                | .34                            |                |
| N             | 268                      |                | 1200                           |                |
| $\ln \bar{w}$ | 1.54                     |                | 1.54                           |                |

can be found working overtime. The wage data used in the regressions is based on the standard hourly wage, not average hourly earnings. For employees working less than 40 hours (or not covered by the overtime provisions of the FLSA) the change in average hourly earnings with respect to hours is  $b_h$ , the coefficient on hours. For workers receiving overtime the appropriate change is,

$$b_h + (.5H - 40 \cdot .5)/H = b_h + (.5 - 20/H) ,$$

due to the presence of an overtime premium for those hours above 40. As an example, using the results from the manufacturing regression, an increase in hours from 35 to 40 would result in an increase in hourly earnings of 7 percent. An increase from 40 to 45, on the other hand, would yield a 13 percent rise in average hourly earnings. Therefore, the manufacturing results will tend to be on the low side if wages adjust in response to regularly scheduled overtime hours.

As a final piece of data on this issue, similar analysis was conducted for males. As noted before, there are very few males working part-time, but there is still substantial variance in hours worked, and the larger sample size allows for separate regressions for 1-digit industries. The coefficients on the hours instrument for the industry-specific wage regressions are displayed in Table B-4. The coefficients are smaller than those from the wives regressions and are generally insignificant. Whether this is due to a flattening of the wage-hours locus as hours increase, the bias imposed by the overtime premium or other reasons is left for future research.

TABLE B-4. HOURS COEFFICIENTS -INDUSTRY-SPECIFIC WAGE REGRESSIONS, MEN

| Industry (SIC)   | $\bar{H}$ | (STD DEV) | $\bar{H}$ | (t) | $R^2$ |
|--|-----------|-----------|-----------|-----|-------|
| Mining (2)   | 50.3      | 13.7      | .004      | .8  | .35   |
| Durables (3)   | 42.8      | 6.6       | .008      | 2.5 | .23   |
| Nondurables (4)  | 43.1      | 6.9       | .015      | 3.5 | .25   |
| Transportation,<br>Communication, and<br>Utilities (6) | 43.0      | 9.9       | .002      | .7  | .22   |
| Trade (7)  | 43.7      | 10.7      | .001      | .4  | .18   |
| Finance and<br>Insurance (8)                           | 41.7      | 8.6       | -.006     | .8  | .32   |
| Services (9)   | 41.1      | 12.1      | .002      | 1.0 | .26   |
| Government (10)  | 41.4      | 8.3       | -.004     | .8  | .15   |

Standard models of the labor market posit a single wage independent of the hours chosen. We suggested theoretical reasons to expect that wages will be dependent on hours of work. The empirical analysis presented in this appendix support this conclusion. The results presented are not intended to be a precise analysis of the labor supply. We have special reservations about the results for married women. Nevertheless, in conjunction with the theoretical results in the main text, they imply that the standard models of labor supply and demand require substantially more thought about the shape of the production function and its implications for hours of work observed in the labor market.

## Appendix C

### AN EMPIRICAL INQUIRY INTO THE RELATIONSHIP BETWEEN HOURS WORKED AND COMPENSATION

This appendix describes the empirical work on the determinants of part-time work in a sample of 13 manufacturing industries over 20 years. The evidence provides strong support for the basic building block of the theory: that productivity expands with hours up to full time. The empirical work also documents the effect on hours and compensation of determinants, such as age, sex, specific vocational preparation, education, capital intensity, and turnover (which is endogenous in some specifications).

#### THE THEORETICAL FRAMEWORK

Long-run competitive equilibrium requires that the value of the entire marginal product per employee accrues to the employee. In figure C-1,  $g(h)$  ( $= c$ ) stands for the employee's marginal product, valued in terms of consumer goods,  $h$  for the daily or weekly hours worked and  $c$  for the worker's compensation or consumption.  $c$  contains all labor costs that constitute remuneration to workers. They do not include nonremunerative labor costs, such as training and supervisory costs and possibly social security and unemployment insurance taxes. Ceteris paribus increases in nonremunerative costs shift the  $g(h)$  function downward and thus reduce the typical employee's compensation. The point in the  $g(h)$  curve, which maximizes worker utility, is at E, where the highest achievable indifference curve is just tangential to the  $g(h)$  function. The next question is: Which factors shift the optimum combination of  $h$  and  $c$ ?

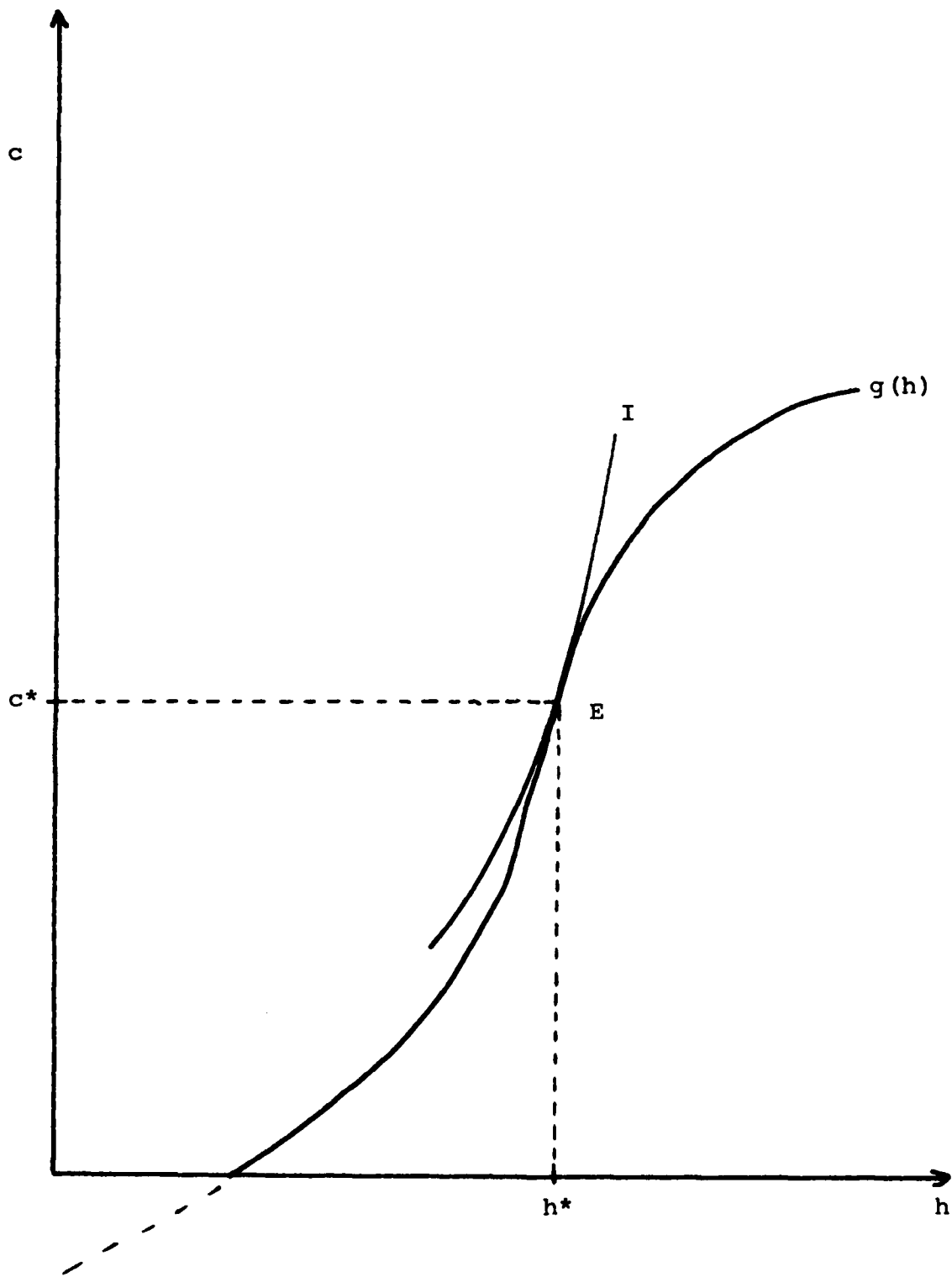


Figure C-1

The point E in figure C-1 may move because of shifts in the  $g(h)$  function, or in the indifference map or both. Let us discuss the most likely factors that may shift the two relationships.

1. Increases in human capital tend to shift upward the level of compensation because it raises the employee's productivity. If leisure is a normal good then the upward movement of the  $g(h)$  function is likely to lead to a rise in  $c$  and a reduction in  $h$ . Increases in human capital may, however, also affect the indifference map. It is plausible that individuals who acquire much human capital also plan to work relatively long hours.
2. Nonremunerative costs, such as costs of training and supervision, tend to lower the  $g(h)$  function and thus reduce  $c$  and possibly raise  $h$  (if leisure is normal). Unfortunately, data on nonremunerative costs are not easily obtained. Hence, in the empirical work, they were approximated by the level of labor turnover. A rise in labor turnover is assumed to raise nonremunerative costs and, hence, to reduce  $c$  and possibly to raise  $h$ .
3. As the age of an employee rises, the  $g(h)$  function tends to move down, and this might lead to an increase in hours (if leisure is a normal good). But the indifference map is likely to rotate in a counterclockwise fashion, and this may lead to a decrease in hours. In either case,  $c$  is likely to fall.

4. The sex of the employee might affect the  $g(h)$  function, but it is more likely to shift the indifference map. We might conjecture that, on average, females have a relatively strong preference for "leisure" especially during the child-bearing ages. If this is correct, then females should be observed to have both lower  $c$ 's and  $h$ 's than males.
5. The degree of unionization may shift the  $g(h)$  function. Since  $c$  is the compensation per employee, measured in consumption goods, an increase in monopolistic power may raise the relevant industry's price relatively to the price of consumption goods and thus raise the  $g(h)$  function. This would tend to raise  $c$  and to lower  $h$ .
6. The degree of capital intensity might affect the  $g(h)$  function in the short run. It is plausible to suggest that an increase in the capital-labor ratio raises the real marginal product of labor and that, therefore, the  $g(h)$  function may rise with capital intensity. In long-run competitive equilibrium, however, relative prices must adjust so that for identical labor and hours  $c$  is the same in all industries irrespective of capital intensity. Thus in the short run, an increase in capital intensity may raise  $c$  and possibly reduce  $h$ .



The theoretical predictions that have been discussed above may now be summarized as follows:

| <u>Increase in</u> | <u>Effect on</u><br><u>Compensation (c)</u> | <u>Hours (h)</u> |
|--------------------|---|------------------|
| Human capital      | +   | ?                |
| Labor turnover     | -   | +                |
| Age                | -   | ?                |
| Unionization       | +   | -?               |
| Capital intensity  | +   | -?               |

The effects on hours are all queried because there is always a possibility that leisure is an inferior good.

#### THE DATA

The empirical investigation of the joint determination of compensation and hours is based on data for 13 two-digit manufacturing industries. Twenty years (1961-80) of information is available for each of the 13 industries. Thus, the total number of observations was 260. In order to remove the effects of the business cycles in the time series, dummy variables for each year were introduced. For the same reason, an industry-specific relative output variable was used as an independent variable.

For some of the variables, only pure cross-sectional data are available. Thus, for age, education, sex, degree of unionization, and skill, data were obtained from the 1970 Census. Only one number was used for each industry for the 20 years.

The sources for the other data series are BLS's Employment and Earnings (for hours, employment labor turnover) and the National Income

and Product Accounts (for compensation of employees, national income).

All time series measured in current dollars were deflated by the relevant industry's wholesale price index.\*

#### THE ESTIMATION

According to the theoretical framework presented above, compensation for employee and hours worked are determined jointly. Hence, there are (at least) two reduced form equations for our model, one for each of the jointly dependent variables. The first step in the estimation consisted of the fitting of reduced form equations to the data by means of ordinary least squares. Table C-1 contains the results of this first experiment. The results can be summarized as follows:

1. The degree of capital intensity tends to raise both compensation and hours worked.
2. Age reduces compensation and seems to have no effect on hours.

\* The deflation could be made using either a price index for the worker's consumption (say, the CPI, or for the firm's output (say, the WPI) for that 2-digit SIC. The reason for this ambiguity is that the model is developed in terms of a single commodity--and this is both consumption good (CPI) and producer good (PI).

More specifically, the relevant variable is  $c = g$ . The variable  $c$  satisfies the equation  $cP_c = wH$ , i.e., the worker consumes his pay. Thus,  $c$  can be measured  $c = wH/P_c$ , or compensation deflated by a consumer price index. The variable  $c$  also equals  $g$  and so can be measured from the equation  $gP_g = wH$ , i.e., pay exhausts output (the return to capital has been taken out), or  $c = g = \frac{wH}{P_g}$ , which suggests

deflating by  $P_g$ , a producer price index. In practice, we resolved the ambiguity arbitrarily deflating by the PPI.

TABLE C-1. REDUCED FORM EQUATIONS (t-ratios in parentheses)

| Independent Variables          | Mean of Independent Variables | Dependent Variable        |                    |
|--------------------------------|-------------------------------|---------------------------|--------------------|
|                                |                               | Compensation <sup>a</sup> | Hours <sup>b</sup> |
| Capital Intensity <sup>c</sup> | 3.58                          | .0434<br>(2.2)            | .0293<br>(2.6)     |
| Age <sup>d</sup>               | 1.68                          | -.8337<br>(2.5)           | .0060<br>(.03)     |
| Education <sup>e</sup>         | 11.99                         | .7595<br>(3.0)            | .1564<br>(1.1)     |
| Sex <sup>f</sup>               | 75.57                         | .0274<br>(2.4)            | .0967<br>(15.0)    |
| Unionization <sup>g</sup>      | 47.33                         | .0032<br>(.4)             | -.0521<br>(11.5)   |
| Skill <sup>h</sup>             | 3.77                          | .1805<br>(3.6)            | -0.2708<br>(6.1)   |
| Labor Turnover <sup>i</sup>    | .022                          | -7.888<br>(1.2)           | 30.7392<br>(8.6)   |
| Mean of Dependent Variable     |                               | 8.010                     | 41.90              |

<sup>a</sup>Compensation per employee, in thousands of 1958 dollars (annual).

<sup>b</sup>Average weekly hours per production worker.

<sup>c</sup>National Income, other than compensation of labor per employee, in thousands of 1958 dollars (annual).

<sup>d</sup>Percentage of employees aged over 65 years.

<sup>e</sup>Average years of education.

<sup>f</sup>Percentage of males.

<sup>g</sup>Percentage of work force unionized.

<sup>h</sup>Specific vocational preparation.

<sup>i</sup>Mean of accession and separation rates, monthly as proportion of production workers.

3. Education raises compensation, but has only a weak positive effect on hours.
4. As the proportion of males rises, both compensation and hours rise.
5. The degree of unionization has no impact on compensation, but reduces hours strongly (so that compensation per hour rises).
6. Increased skill raises compensation, but reduces hours.
7. Labor turnover reduces compensation fairly weakly, but raises hours significantly.

By and large the empirical results in table C-1 bear out the theoretical predictions presented earlier.

One (possibly serious) drawback of the reduced form specification underlying table C-1 is that the level of labor turnover is treated as exogenous. In an alternative specification, labor turnover is treated as an additional jointly endogenous variable, so there are three reduced forms, one each for compensation, hours, and labor turnover. The regression coefficients for the alternative reduced form specification are presented in table C-2. A comparison of the coefficients in table

TABLE C-2. REDUCED FORM EQUATIONS WITH ENDOGENOUS LABOR TURNOVER  
(t-ratios in parentheses)

| Independent <sup>a</sup><br>Variables | Dependent Variable <sup>a</sup> |                 |                 |
|---------------------------------------|---------------------------------|-----------------|-----------------|
|                                       | Compensation                    | Hours           | Labor turnover  |
| Capital Intensity                     | .0377<br>(2.0)                  | -.0069<br>(.6)  | .007<br>(3.9)   |
| Age                                   | -1.0883<br>(4.1)                | .9862<br>(5.8)  | .0322<br>(11.9) |
| Education                             | .6510<br>(2.8)                  | .5795<br>(3.8)  | .0138<br>(5.7)  |
| Sex                                   | .0299<br>(2.6)                  | .0870<br>(11.9) | -.0003<br>(2.7) |
| Unionization                          | -.0010<br>(0.1)                 | -.0359<br>(7.6) | .0005<br>(7.0)  |
| Skill                                 | .3130<br>(4.2)                  | -.3977<br>(8.3) | -.0041<br>(5.4) |

<sup>a</sup>For definitions and means of variables, see table C-1.

C-1 with those in table C-2 yields the following conclusions:

1. The coefficients for the compensation equations are reasonably close in the sense that they lie within two standard errors of one another.
2. In the case of the coefficients of the hours equation, on the other hand, the exclusion of labor turnover, leads to some significant changes. In particular, the coefficient for capital intensity drops from a significant positive to an insignificant negative value; those of age and education rise from low positive to high positive and significant values; the coefficient for sex is not changed by much; those for unionization and skill become less and more negative, respectively.
3. Labor turnover is related significantly to each of the other exogenous variables. This is, of course, the reason for the differences in the estimated coefficients for the compensation and hours equation presented in tables C-1 and C-2.

In view of the substantial amount of multicollinearity in the hours equation of table C-1, its coefficients should be treated with caution. This warning is especially applicable to the coefficients of capital intensity and age.

Let us now turn to a discussion of the estimation of the structural equations of the model. Compensation and hours equations were computed

by means of standard two-stage least squares. Since the relationship between compensation and hours is likely to be nonlinear, let us briefly discuss its specification. Johnston (Econometric methods, 2nd ed. p. 52-53) suggests a logarithmic, reciprocal transformation to obtain a curve that looks like the  $g(h)$  function as drawn in the diagrams in previous sections of this report. This function has the form of  $\ln c = \alpha - \beta/2$ . It has a positive first derivative and an inflection point of  $h = \beta/2$ . This functional form was used in one specification of the compensation equation. In the second specification, a double logarithmic transformation was applied to compensation and hours. In the hours equation, a double logarithmic transformation was also used.

In the two-stage procedure, a decision has to be made on the number and kinds of exogenous variables that are to be included in the structural equations. In theory, exogenous variables that generate a movement along the  $c = g(h)$  function should be excluded from the structural equations while those that shift this function should be included. By this criterion, sex is the most plausible candidate for exclusion. Some experimentation showed, however, that capital intensity and education tended to be highly insignificant, and so they also were excluded as exogenous variables in the structural equations.

Tables C-3 and C-4 contain the results of two sets of estimations. For table C-3, labor turnover was assumed to be exogenous to the system of equations, while for table C-4, labor turnover was treated as a jointly dependent variable. Unfortunately, this difference in specification tends to generate some significant differences in the results.

TABLE C-3. TWO-STAGE LEAST SQUARES ESTIMATION WITH EXOGENOUS LABOR  
TURNOVER (t-ratios in parentheses)

| Right-Hand Variables | Dependent Variables      |                     | ln (Hours)         |
|----------------------|--------------------------|---------------------|--------------------|
|                      | ln (Compensation)<br>(a) | (b)                 |                    |
| ln (Compensation)    |                          |                     | .2862<br>(4.8)     |
| ln (Hours)           |                          | 2.1197<br>(4.0)     |                    |
| Reciprocal of Hours  | -87.2559<br>(4.0)        |                     |                    |
| Capital Intensity    | (X)                      | (X)                 | (X)                |
| Age                  | -.2331(X)<br>(10.6)      | -.2333(X)<br>(10.6) | .0634(X)<br>(3.9)  |
| Education            | (X)                      | (X)                 | (X)                |
| Sex                  | (X)                      | (X)                 | (X)                |
| Unionization         | .0019(X)<br>(2.4)        | .0192(X)<br>(2.3)   | -.0007(X)<br>(2.9) |
| Skill                | .0640(X)<br>(9.7)        | .0641(X)<br>(9.7)   | -.0172(X)<br>(3.7) |
| Labor Turnover       | -.8651(X)<br>(1.2)       | -.8921(X)<br>(1.2)  | .4792(X)<br>(2.3)  |

Note: (X) means that the variable was used as an instrumental variable.



TABLE C-4. TWO-STAGE LEAST SQUARES ESTIMATION WITH ENDOGENOUS LABOR  
TURNOVER (t-ratios in parentheses)

| Right-Hand Variables | Dependent Variables      |                     |                    |
|----------------------|--------------------------|---------------------|--------------------|
|                      | ln (Compensation)<br>(a) | (b)                 | ln (Hours)         |
| ln (Compensation)    |                          |                     | .3762<br>(4.2)     |
| ln (Hours)           | 2.6477<br>(4.2)          |                     |                    |
| Reciprocal of Hours  |                          | -109.843<br>(4.2)   |                    |
| Capital Intensity    | (X)                      | (X)                 | (X)                |
| Age                  | -.3281<br>(7.8)          | -.3299(X)<br>(7.8)  | .1239(X)<br>(3.9)  |
| Education            | (X)                      | (X)                 | (X)                |
| Sex                  | (X)                      | (X)                 | (X)                |
| Unionization         | -.00004(X)<br>(.04)      | -.00004(X)<br>(.03) | .00001(X)<br>(.04) |
| Skill                | .0807(X)<br>(8.5)        | .0807<br>(8.5)      | -.0304(X)<br>(3.8) |
| Labor Turnover       | 3.9512<br>(2.1)          | 4.0307<br>(2.1)     | -1.4877<br>(1.9)   |

Note: (X) means that the variable was used as an instrumental variable.

The empirical findings can be summarized as follows:

1. An important and apparently robust finding concerns the relationship between compensation and hours. The elasticity of compensation with respect to hours is 2.1 in table C-3 and 2.65 in table C-4. Furthermore, the coefficient of the reciprocal of hours suggests that the nonlinear relationship has an inflection point at  $110/2 = 55$  or  $87/2 = 43.5$  hours, below which the first derivative of compensation with respect to hours is increasing. Similar results are obtained from the elasticities of hours with respect to compensation. Their reciprocals are 3.49 (table C-3) and 2.66 (table C-4). Thus, in the case of table C-4, the reciprocal of one elasticity is virtually identical to the value of the other elasticity. In the case of table C-3, the hours equation implies a steeper reaction of compensation to hours than does the compensation equation. Table C-5 contains the ranges of the elasticity of compensation with respect to hours obtained by deducting and adding two standard errors to the point estimates (or their reciprocals) in tables C-3 and C-4.

TABLE C-5. FOUR-STANDARD-ERROR RANGES OF ESTIMATED ELASTICITY  
OF COMPENSATION WITH RESPECT TO HOURS

|                       | Table C-3    | Table C-4    |
|-----------------------|--------------|--------------|
| Compensation Equation | 1.06 to 3.18 | 1.39 to 3.9  |
| Hours Equation        | 2.47 to 5.99 | 1.80 to 5.08 |

The combined evidence of tables C-3, C-4, and C-5 suggests strongly that the elasticity of compensation with respect to hours exceeds unity and may well be as large as two. This finding lends support to the proposition put forward in our paper, namely, that there are substantial penalties to working short hours.

2. Age tends to reduce compensation, but raise the level of hours. This result is also quite robust. The positive impact on hours is somewhat surprising, but it can be explained by a positive income effect on leisure.
3. The influence of unionization is mixed. In table C-3, we have plausible significant coefficients, positive for compensation and negative for hours. But in table C-4, both effects vanish.
4. The influence of skill is significant and plausible, positive on compensation and negative on hours. This is a fairly robust result.

5. The effects of labor turnover are mixed and depend crucially on the specification of the model. When labor turnover is assumed to be exogenous (table C-3), the results are plausible. But the coefficients change signs when labor turnover is assumed to be jointly endogenous (table C-4). Such sign changes are unfortunate and must be read as a warning signal. It would appear that labor turnover has not yet been incorporated satisfactorily into our models of the working of the labor market.

The empirical finding of our two-stage-least-squares analysis is that the relationship between compensation and hours seems to be steep and that its first derivative is rising. In spite of some remaining specification problems, this finding appears to be robust. It is also in conformity with our main proposition, namely, that reductions in hours imply substantial losses in compensation.

#### RESULTS BASED ON A 1970 CROSS SECTION

The analysis carried out on the pooled sample was replicated using a pure industry cross section for the year 1970. Aside from confirming or denying, the 1970 cross section had another purpose to allow a much wider range of industries to be considered--trade and services were added to manufacturing.

As in the pooled data, there are two jointly dependent variables: compensation per employee and weekly hours.

Compensation per employee from the 1970 National Income Accounts includes both wages and salaries and nonwage compensation. Weekly hours are from the 1970 Census of Populations (Census hereafter) industry characteristics.

The right-hand variables included fraction male (Census) skill level\*; average age (Census), capital intensity\*\*; a dummy variable indicating direct contact with the public; the fraction self-employed (Census); the fraction of the industry labor force unionized (Freeman); and the average establishment size (Census of Manufactures, Trade, and Mineral Industries). A complete set of variables could be constructed for a sample of 34 industries at roughly the two-digit level of aggregation.

We estimated reduced forms for compensation and hours and two-stage least squares estimates of the production function relating hours and compensation. The reduced form equations are shown in table C-6.

The cross sectional reduced form equations bear a strong resemblance to the reduced form equations based on the pooled data. The signs on age, union, fraction male, skill, and years in school are identical between the cross section and pooled regression. The cross section excludes two variables used in the pooled sample, capital intensity (which was not significant), and turnover (which is not available outside of manufacturing and a few other industries). The cross section

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\* The fraction of nonprofessional workers who were in trade occupations.

\*\* GNP accounts  $\frac{\text{value added} - \text{employee compensation}}{\text{value added}}$  .

TABLE C-6. REDUCED FORM EQUATIONS PURE CROSS SECTION  
(t ratios in parentheses)

| Independent Variables       | Dependent Variables |                 |
|-----------------------------|---------------------|-----------------|
|                             | ln (Compensation)   | ln (Hours)      |
| Intercept                   | 2.07<br>(.88)       | 3.64<br>(5.13)  |
| ln (Age)                    | -.65<br>(-1.91)     | .04<br>(.40)    |
| ln (Union)                  | .044<br>(1.41)      | -.012<br>(-1.3) |
| ln (Fraction Males)         | .51<br>(5.00)       | .15<br>(5.02)   |
| ln (Fraction Self-Employed) | -.08<br>(-1.86)     | .016<br>(1.26)  |
| ln (Skill)                  | .33<br>(3.54)       | -.03<br>(-1.11) |
| ln (Establishment Size)     | .049<br>(1.18)      | .076<br>(1.26)  |
| ln (Years in School)        | .66<br>(1.07)       | .030<br>(.16)   |
| R <sup>2</sup>              | .87                 | .77             |
| Adj. R <sup>2</sup>         | .83                 | .71             |
| N                           | 34                  | 34              |

includes two new variables--establishment size and fraction self-employed. Large establishments seem to have greater compensation and hours, while self-employment leads to longer hours and lower pay (per hour). The self-employment result seems quite reasonable since self-employment is a means of relaxing statutory requirements for an overtime premium. The size variable represents the effect of teamwork--which raises output and puts a premium on higher hours (part-timers are harder to fit in to a larger team).

We also constructed structural estimates of the production function (the compensation-hours relation) by means of two-stage least squares. The two stage estimates are shown in table C-7.

The cross-section equations should be compared to equation (b) in table C-3 for the pooled data. Cross-section equation (a) is similar in specification, and cross-section equation (b) is almost identical to pooled equation (b). The elasticities of compensation with respect to hours are similar--1.8 and 2.1 for the cross-section regressions, 2.1 for the pooled data. Thus, the cross-sectional data provide further support for the finding that reductions in hours imply losses in per-hour compensation. The effects of unionization, skill, education, and size are all positive, as expected. The effect of age is negative.

TABLE C-7. TWO-STAGE LEAST SQUARES ESTIMATES (CROSS SECTION)  
(t-Values in parentheses)

| Right-Hand<br>Variables     | Dependent Variable:<br>ln (Annual Compensation Per Employee) |                    |
|-----------------------------|--|--------------------|
|                             | (a)  | (b)                |
| Intercept                   | -8.01<br>(-4.05)   | (-3.85)<br>(-1.64) |
| ln (Hours)                  | 1.80<br>(3.36)   | 2.10<br>(4.33)     |
| ln (Union)                  | .07 (X)<br>(1.95)  | .08 (X)<br>(-2.04) |
| ln (Skill)                  | .28 (X)<br>(2.55)  | .41 (X)<br>(3.98)  |
| ln (Education)              | 1.03 (X)<br>(1.49)   | (X)                |
| ln (Size)                   | .10 (X)<br>(3.24)  | .10 (X)            |
| ln (Fraction Male)          | (X)  | (X)                |
| ln (Fraction Self-Employed) | (X)  | (X)                |
| ln (Age)                    | (X)  | -.80<br>(-2.08)    |
| R <sup>2</sup>              | .76  | .76                |
| Adj. R <sup>2</sup>         | .72  | .72                |
| N                           | 34   | 34                 |

Note: (X) means that the variable was used as an instrumental variable.



## Appendix D

### POLICY ANALYSIS

In this appendix, we show how the theory we develop in the text is used to estimate the effect of federal policy. We consider three specific policies:

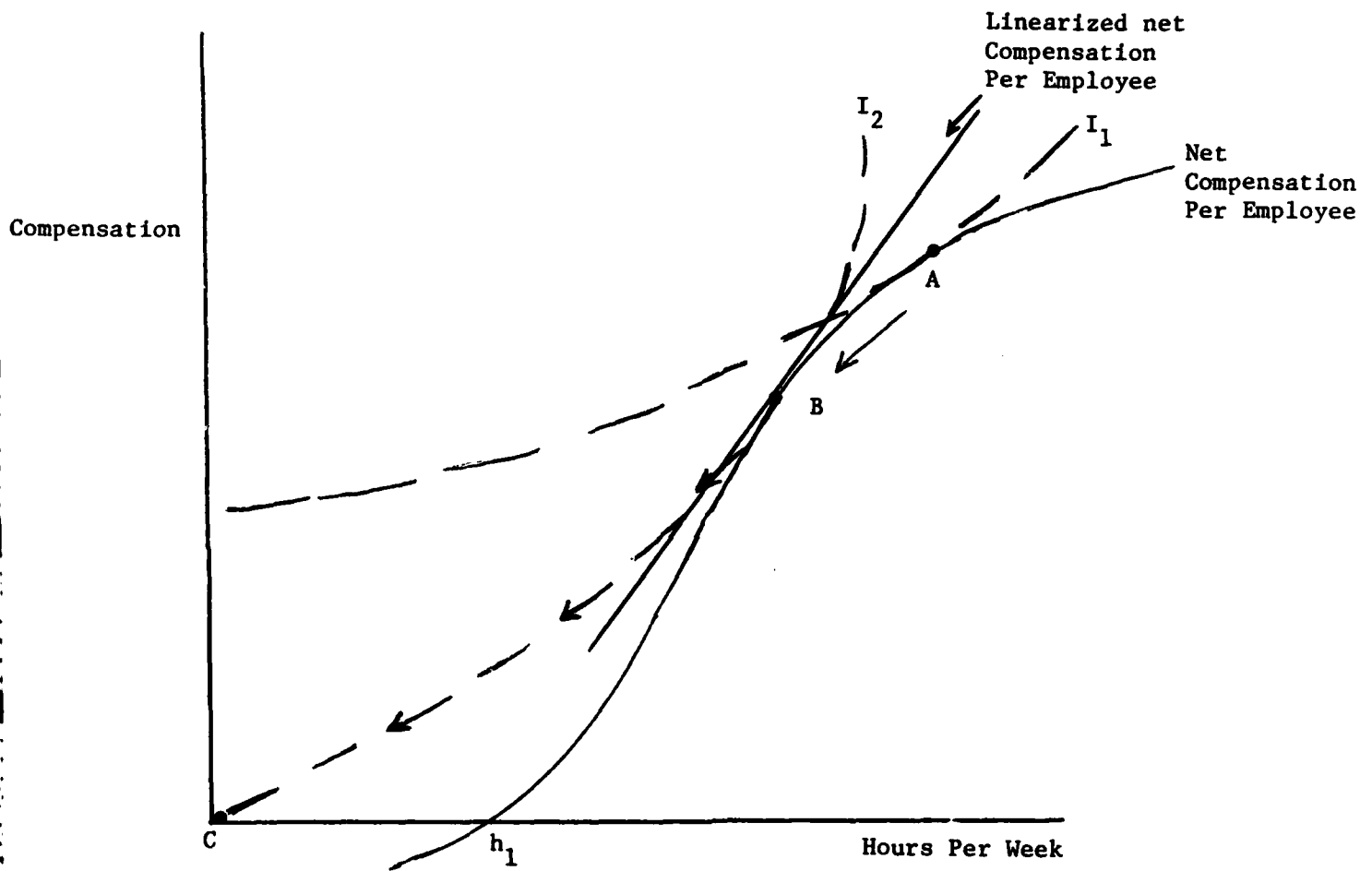
- o A decrease in social insurance costs
- o The Social Security earnings' limit
- o A subsidy on hiring older workers.

The same techniques can be applied to other policies as well.

The calculations are based on a mathematical version of figure D-1, which is similar to some of the figures in appendix A. In the mathematical version of the theory, used for the policy analysis, the production function is approximated by the straight (solid) line shown in the figure.

An important determinant of whether an older worker chooses full time work, part-time work, or retires completely is the shape of indifference curves like  $I_0$ , which show his trade-off between income and leisure. One reason that  $I_0$  has an upward slope is that the worker has the option of working at other times of his life. In the mathematical model, we represent this option with an explicit life-cycle theory.

Fig. D-1. The Retirement Decision.



The linearized production function is chosen so that total compensation at 40 hours equals \$320. This is approximately equal to median weekly earnings. The slope and intercept parameters are then varied, to allow for different levels of fixed cost (represented by a negative intercept), creating a penalty, in terms of average hourly earnings, for work less than 40 hours. In the tables that follow, the level of the part-time penalty is represented by the ratio of average earnings at 20 hours to average earnings at 40.\*

Given this earnings-hours locus, we assume a life-cycle utility model and allow individuals to choose the number of hours worked. We construct a three-period model of the form,

$$U = A_0 L_1^\alpha L_2^\beta L_3^\gamma Y^\delta, \quad (D-1)$$

subject to,

$$L_1 + H_1 = TA \quad (D-2a)$$

$$Y = \sum_j (wH_j - T) \quad (D-2b)$$

where

TA = total time available

w = hourly wage

T = fixed cost

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\* Due to the linearity of the model, this ratio equals the ratio of fixed costs to total compensation at 40 hours.

L = leisure

H = hours worked

and the model is normalized by

$$\alpha + \beta + \gamma + \delta = 1 .$$

Additionally, the model is constructed so that period 1 is 3.5 times as long as each of the succeeding periods. Assuming that each of the last periods is equal to 10 years, this model can be viewed as representing three periods: the first from age 21 to 55, the second from 56 to 65, and the third from 66 to 75. The model is designed so that, absent any fixed costs, the typical individual would gradually reduce his hours in each period.

Table D-1 presents simulation results. Parameter values were chosen such that, in the case of no part-time penalty, an individual would work 40 hours per week in the first period, 30 hours in the second period, and 20 in the last. The table displays the optimal hours in each period and the average annual earnings per year (inclusive of retirement years). The results presented assume a fixed requirement of 8 hours of sleep per day, i.e.,  $TA = 7 \times (24 - 8)$ . If  $TA$  is set equal to 168 ( $7 \times 24$ ), retirement becomes more likely.

Column 1 indicates the effects of different part-time penalties on labor supply over the lifetime. In this model, any part-time penalty over 5 percent will lead to retirement at age 65 rather than reduced

TABLE D-1. HOURS SUPPLIED PER PERIOD AND AVERAGE ANNUAL EARNINGS

| 1 - Part-Time<br>Penalty | Status Quo<br>(1)          | Federally Mandated<br>Expenditures<br>Eliminated<br>(2) | Elderly Bonus<br>Program<br>(3) |
|--------------------------|----------------------------|---|---------------------------------|
| 1.0                      | 40, 30, 20<br>14,371       | 39.6, 29.6, 19.5<br>15,815                              | 39.7, 29.7, 19.6<br>14,429      |
| .95                      | 41.2, 31.4, 21.6<br>14,833 | 40.8, 31.0, 21.1<br>16,317                              | 40.9, 31.1, 21.2<br>14,891      |
| .90                      | 44.7, 35.3, --<br>14,779   | 44.6, 35.3, --<br>16,178                                | 42.1, 32.4, 22.6<br>15,353      |
| .85                      | 45.7, 36.5, --<br>15,224   | 45.6, 36.4, --<br>16,662                                | 43.1, 33.5, 24.0<br>15,815      |
| .8                       | 46.6, 37.5, --<br>15,668   | 46.5, 37.4, --<br>17,145                                | 46.6, 37.5, --<br>15,668        |
| .75                      | 47.4, 38.4, --<br>16,112   | 47.4, 38.4, --<br>17,629                                | 47.4, 38.4, --<br>16,112        |
| .70                      | 48.2, 39.3, --<br>16,557   | 48.1, 39.3, --<br>18,113                                | 48.2, 39.3, --<br>16,557        |
| .65                      | 54.1, --, --<br>15,613     | 53.8, --, --<br>17,147                                  | 54.1, --, --<br>15,613          |

TA = 112;  $H_1^* = 40$ ,  $H_2^* = 30$ ,  $H_3^* = 20$

hours. A part-time penalty of more than 30 percent will lead to retirement at the end of the first period. As noted before, the ratio of part-time to full-time pay is equivalent to the ratio of fixed cost to total compensation. Referring to table 3, we find that fixed nonremunerative costs are between 10 and 20 percent of total compensation. It is interesting to note that, within this range, we find retirement at age 65, and quite reasonable values for weekly hours.

It is often argued that federally mandated costs can explain the lack of part-time work for older workers. The findings in column 2 suggest that this isn't the case. In the simulation displayed there, all federally mandated costs were eliminated. While this does significantly increase earnings, it has virtually no effect on the retirement decision. The explanation for this becomes apparent when we return to table 3. Most of the costs that are eliminated are variable rather than fixed.

If it is a policy objective to increase the amount of work by older workers, then policies other than changing social insurance taxes must be employed. Column 3 illustrated a hypothetical program. In this simulation, workers over 65 are paid \$20 per week if they work. As can be seen, over some range of values of the part-time penalty,\* this program would induce older workers to remain in the labor force rather than retire. This program affects retirement because it concentrates on fixed rather than variable cost. We don't propose that the government adopt an elderly worker bonus program, but this hypothetical program

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\* Again, we note that it is this range, .8 to .9, in which the values in table 3 suggest we are.

illustrates the powerful effect of fixed costs on the retirement decision.

An often cited reason for not observing more older workers in the labor force is the earnings test imposed on Social Security recipients. For Social Security recipients, earnings above a certain limit reduce Social Security benefits at a rate of 50 cents for each additional dollar earned. A spike in the earnings distribution, at the earnings limit, is observed empirically for older workers. The following simulations examine the effect of this earnings test on the hours of older workers.

In the previous simulation, it was the case that, for reasonable values of the part-time penalty, retirement occurred before age 65, and therefore, the earnings test is irrelevant. We know that, although most workers retire by age 65, many continue in the labor force. We chose alternative parameter values (specifically, we set desired hours, in the absence of fixed costs, to 30 in the third period) that make retirement less likely. Column 1 in table D-2 shows that workers remain in the labor force until age 75 for most of the range of fixed-cost values.

The effect of an earnings limit of \$6,600 (after which a 50 percent tax is imposed) is illustrated in column 2.\* When the part-time penalty is small, older workers remain in the labor force, but work only until they reach the earnings limit. For those values of the part-time penalty that seem most reasonable (15 to 20 percent), the earnings limit results in complete retirement. At higher levels, as in the previous

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\* We make the rather heroic assumption that employees work an even number of hours each week rather than working the desired number of weekly hours, but reducing weeks worked per year.

TABLE D-2. HOURS SUPPLIED PER PERIOD IN THE PRESENCE OF A SOCIAL SECURITY EARNINGS LIMIT

| 1 - Part-Time<br>Penalty | No Earnings Cap<br>(1)     | \$6,600 Earnings Cap<br>(2) | \$10,000 Earnings Cap<br>(3) |
|--------------------------|----------------------------|-----------------------------|------------------------------|
| 1.0                      | 40, 30, 30<br>14,749       | 41.9, 32.2, 15.9*<br>14,727 | 40.8, 30.9, 24.0*<br>14,959  |
| .95                      | 41.2, 31.4, 31.4<br>15,614 | 43.2, 33.6, 17.0*<br>15,186 | 42.1, 32.4, 24.8*<br>15,417  |
| .90                      | 42.3, 32.7, 32.7<br>16,100 | 44.3, 34.9, 18.1*<br>15,644 | 43.3, 33.8, 25.5*<br>15,876  |
| .85                      | 43.4, 33.8, 33.8<br>16,586 | 47.2, 38.2, --<br>15,654    | 44.4, 35.0, --<br>16,335     |
| .80                      | 44.3, 34.9, 34.9<br>17,072 | 48.1, 39.2, --<br>16,113    | 48.1, 39.2, --<br>16,113     |
| .75                      | 48.9, 40.1, --<br>16,572   | 48.9, 40.1, --<br>16,572    | 48.9, 40.1, --<br>16,572     |
| .70                      | 49.6, 41.0, --<br>17,031   | 49.6, 41.0, --<br>17,031    | 49.6, 41.0, --<br>17,031     |
| .65                      | 55.3, --, --<br>16,070     | 55.3, --, --<br>16,070      | 55.3, --, --<br>16,070       |

\* Indicates that earnings equal the earnings limit.

TA = 112;  $H_1^* = 40$ ,  $H_2^* = 30$ ,  $H_3^* = 30$



simulations, retirement occurs before the earnings test comes into play. These findings suggest that although Social Security taxes don't appear to be a significant reason for sudden retirement, the imposition of an earnings test on benefits may have a dramatic effect. The earnings test will cause older workers to significantly reduce hours or retire completely when they might have gradually reduced hours while continuing to work.

The impact of an earnings limit depends on the level at which it is set. Column 3 displays the impact of an increase in the limit to \$10,000. As the limit is raised, its impact is lessened. For example, when the part-time penalty is 15 percent, our typical worker remains working rather than retire. One can see that the effect will be greater for higher income individuals or for those with a greater taste for work. As these results indicate, the effect of the earnings limit depends on several factors, but at a set of parameter values that seem to be reasonable, the effect is significant.

From a policy evaluation perspective, the impact of federally mandated expenditures on retirement seem quite small because they are largely variable. We should note, however, that federally mandated costs other than those in table 3, i.e., costs imposed by OSHA, EPA, etc., are not considered. On the other hand, the earnings test for Social Security benefits may have large impact.

The simulation results provided in this appendix are intended as a general guide to the empirical importance of the theoretical findings in our paper. The model is a very simplified construct. It assumes that wages are constant over the lifetime, ignores progressive taxes and

overtime premiums, and doesn't consider the general equilibrium effects of the policies tested. Nonetheless, the results seem reasonable and, in fact, are much more dramatic than we anticipated. These findings indicate that fixed, nonremunerative costs are not only theoretically interesting, but also empirically important as an explanation for sudden retirement.

## Appendix E

### THE AGE COMPOSITION OF DIFFERENT INDUSTRIES

The information in this appendix is drawn from the LEED file, a longitudinal file of Social Security records for a 1 percent sample of all workers covered by Social Security. The tabulations here are based on a sample of about 10,000 records from this file.

Table E-1 gives the industry SIC codes. Table E-2 gives the number of records in each age and industry category. To capture long-term trends, we present tabulations for 1957, the first year of the LEED data, and 1975, the last year.

The item of interest is the numerical importance of older workers in different industries. Table E-3 provides this information in detailed form, showing the age distribution in each industry on a percentage basis. Table E-4 and table E-5 provide it in summary form, recording the fraction of the work force in each industry over 45 and over 60 for the years 1957 and 1975, respectively. To facilitate location of the industries with the most and the fewest older workers, the industries are ordered by the percentage of workers over 45 years.

As can be seen, the work force in the sample was older in 1975 than 1957. In part, this aging is a true reflection of the aging of the population; in part, it is a statistical artifact of the sample. In any event, industry rankings should be unaffected.

Different industries have the greatest concentration of older workers at different times. Table E-6 describes the transitions.

TABLE E-1

## INDUSTRY GROUPS ANALYZED

| <u>SIC</u> | <u>Abbreviation</u> | <u>Industry</u>  |
|------------|---------------------|--|
| 01         | AGRIC               | Agriculture Production Crops   |
| 07         | AGRSE               | Agricultural Services  |
| 09         | FISH                | Fishing, Hunting, Trapping   |
| 10         | METMI               | Metal Mining   |
| 11         | ANTMI               | Anthracite Mining  |
| 12         | COAL                | Bituminous Coal and Lignite Mining   |
| 13         | GASEX               | Oil and Gas Extraction   |
| 14         | NONMET              | Mining and Quarrying of Nonmetallic Minerals                                   |
| 15         | BCONST              | Building Construction  |
| 16         | CONSRT              | Construction Other Than Building   |
| 17         | SPCONS              | Special Trade Contractors  |
| 19         |                     |  |
| 20         | FOOD                | Food & Kindred Products  |
| 21         | TAB                 | Tobacco Manufactures   |
| 22         | TEXT                | Textile Mill Products  |
| 23         | APPARL              | Apparel and Other Finished Products Made From<br>Fabrics and Similar Materials |
| 24         | WOOD                | Lumber and Wood Products   |
| 25         | FURN                | Furniture and Fixtures   |
| 27         | PRINT               | Printing, Publishing, and Allied Industries                                    |
| 28         | CHEM                | Chemicals and Allied Products  |
| 29         | PETRO               | Petroleum Refining and Related Industries                                      |
| 30         | RUBBER              | Rubber and Misc. Plastic Products  |
| 31         | LEATH               | Leather and Leather Products   |
| 32         | GLASS               | Stone, Clay, Glass, and Concrete Products                                      |
| 33         | PRIM                | Primary Metal Industries   |
| 34         | FABMET              | Fabricated Metal Products  |
| 35         | MACH                | Machinery (except electrical)  |
| 36         | ELMACH              | Electrical Machinery and Equipment   |
| 37         | TRANEQ              | Transportation Equipment   |
| 38         | MESUR               | Measuring, Analyzing, and Controlling<br>Instruments                           |
| 41         | LTRANS              | Local and Suburban Transit   |
| 42         | FRTRAN              | Motor Freight Transportation and Warehousing                                   |
| 43         | POSTAL              | U.S. Postal Service  |
| 44         | WATER               | Water Transportation   |
| 45         | AIR                 | Air Transportation   |
| 46         | PIPLIN              | Pipelines (except natural gas)   |
| 47         | TRANS               | Transportation Services  |
| 48         | COMM                | Communication  |
| 49         | ELGAS               | Electric Gas and Sanitary Services   |
| 50         | DUR                 | Wholesale Trade--Durable Goods   |
| 51         | NONDUR              | Wholesale Trade--Nondurable Goods  |

TABLE E-1 (Cont'd)

| <u>SIC</u> | <u>Abbreviation</u> | <u>Industry</u>   |
|------------|---------------------|---|
| 52         | BLDMAT              | Building Materials  |
| 53         | GMERCH              | General Merchandise Stores                                    |
| 54         | FOOD                | Food Stores   |
| 55         | GASTAT              | Gas Service Stations  |
| 56         | APSTOR              | Apparel and Accessory Stores                                  |
| 57         | FURSTO              | Furniture Stores  |
| 58         | EAT                 | Eating and Drinking Places                                    |
| 59         | RETAIL              | Misc. Retail  |
| 60         | BANK                | Banking   |
| 61         | CREDIT              | Credit Agencies   |
| 62         | BROKER              | Security and Commodity Brokers                                |
| 63         | INS                 | Insurance   |
| 64         | INSAGT              | Insurance Agents  |
| 65         | RESTAT              | Real Estate   |
| 66         | LOANS               | Combinations of Real Estate, Insurance, Loans,<br>Law Offices |
| 67         | HOLD                | Holding and Other Investment Offices                          |
| 70         | HOTEL               | Hotels and Rooming Houses                                     |
| 72         | PERSER              | Personal Services   |
| 73         | BUSER               | Business Services   |
| 75         | REPAIR              | Automotive Repair   |
| 76         | MISRE               | Misc. Repair Services   |
| 77         |                     |   |
| 78         | MOTION              | Motion Pictures   |
| 79         | AMUSE               | Amusement and Recreation                                      |
| 80         | HEALTH              | Health Services   |
| 81         | LEGAL               | Legal Services  |
| 82         | EDUC                | Educational Services  |
| 83         | SOCIAL              | Social Services   |
| 84         | ART                 | Museums, Art Galleries  |
| 86         | MEMORG              | Membership Organizations                                      |
| 88         | PRIHH               | Private Households  |
| 89         | MISERV              | Misc. Services  |
| 90         |                     |   |
| 97         | NATSEC              | National Security and International Affairs                   |
| 99         | NONCLAS             | Nonclassifiable Establishments                                |

TABLE E-2  
FREQUENCY OF AGE BY INDUSTRY  
1957 AND 1975

| Year 1957   |         |       |       |       |       |       |       |       |       |       |       |       |       |        |
|-------------|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| SIC         | IND     | 21-25 | 26-30 | 31-35 | 36-40 | 41-45 | 46-50 | 51-55 | 56-60 | 61-65 | 66-70 | 71-75 | 76-80 | TOTALS |
| 1           | AGRIC   | 174   | 94    | 72    | 67    | 70    | 47    | 41    | 36    | 22    | 9     | 10    | 4     | 650    |
| 2           | AGRSE   | 4     | 8     | 1     | 11    | 1     | 2     | 4     | 3     | 1     | 1     | 0     | 0     | 35     |
| 9           | FISH    | 0     | 2     | 2     | 0     | 1     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 5      |
| 10          | METMI   | 3     | 4     | 0     | 1     | 2     | 2     | 1     | 0     | 0     | 0     | 1     | 1     | 15     |
| 11          | ANMI    | 0     | 1     | 0     | 1     | 1     | 3     | 0     | 0     | 0     | 0     | 0     | 0     | 5      |
| 12          | COAL    | 7     | 1     | 2     | 0     | 7     | 3     | 3     | 2     | 3     | 0     | 0     | 0     | 22     |
| 13          | GASEX   | 7     | 23    | 25    | 5     | 6     | 3     | 1     | 4     | 0     | 1     | 0     | 0     | 72     |
| 14          | NONMET  | 4     | 2     | 3     | 4     | 3     | 2     | 2     | 1     | 0     | 0     | 0     | 0     | 25     |
| 15          | BOONST  | 29    | 16    | 47    | 43    | 61    | 25    | 25    | 15    | 19    | 4     | 3     | 0     | 292    |
| 16          | CONSTR  | 17    | 25    | 30    | 36    | 25    | 15    | 21    | 13    | 2     | 3     | 2     | 0     | 202    |
| 17          | SPCONS  | 59    | 33    | 72    | 45    | 63    | 43    | 40    | 12    | 16    | 9     | 6     | 1     | 427    |
| 19          |         | 4     | 1     | 0     | 8     | 0     | 1     | 0     | 0     | 0     | 0     | 0     | 0     | 14     |
| 20          | FOOD    | 48    | 35    | 17    | 51    | 26    | 27    | 17    | 18    | 11    | 5     | 2     | 1     | 259    |
| 21          | TAB     | 3     | 0     | 2     | 1     | 1     | 0     | 0     | 0     | 0     | 1     | 0     | 0     | 8      |
| 22          | TEXT    | 19    | 6     | 23    | 16    | 15    | 17    | 11    | 9     | 5     | 1     | 1     | 1     | 130    |
| 23          | APPARL  | 43    | 47    | 40    | 35    | 24    | 40    | 23    | 24    | 10    | 5     | 2     | 6     | 299    |
| 24          | WOOD    | 15    | 13    | 15    | 9     | 10    | 13    | 4     | 4     | 0     | 3     | 0     | 0     | 86     |
| 25          | FURN    | 10    | 8     | 8     | 17    | 5     | 10    | 7     | 3     | 2     | 0     | 0     | 0     | 74     |
| 26          | PAPER   | 5     | 7     | 6     | 6     | 6     | 7     | 5     | 4     | 1     | 1     | 3     | 0     | 53     |
| 27          | PRINT   | 27    | 14    | 12    | 14    | 32    | 20    | 17    | 8     | 7     | 4     | 2     | 0     | 157    |
| 28          | CHEM    | 17    | 17    | 6     | 14    | 20    | 17    | 8     | 7     | 6     | 6     | 1     | 0     | 123    |
| 29          | PETRO   | 2     | 5     | 2     | 4     | 2     | 1     | 1     | 3     | 1     | 1     | 0     | 0     | 22     |
| 30          | RUBBER  | 11    | 17    | 9     | 6     | 2     | 2     | 4     | 1     | 5     | 3     | 1     | 0     | 61     |
| 31          | LEATH   | 10    | 5     | 8     | 15    | 10    | 6     | 7     | 8     | 2     | 2     | 0     | 0     | 73     |
| 32          | GLASS   | 16    | 10    | 14    | 7     | 10    | 10    | 9     | 9     | 7     | 2     | 0     | 0     | 94     |
| 33          | PRIN    | 30    | 21    | 18    | 31    | 26    | 17    | 16    | 12    | 6     | 4     | 3     | 0     | 184    |
| 34          | FABMET  | 29    | 22    | 20    | 20    | 32    | 24    | 16    | 6     | 14    | 3     | 1     | 0     | 197    |
| 35          | MACH    | 45    | 21    | 21    | 37    | 25    | 27    | 20    | 11    | 23    | 6     | 2     | 1     | 240    |
| 36          | ELMACH  | 49    | 33    | 35    | 22    | 27    | 25    | 14    | 11    | 4     | 8     | 2     | 1     | 231    |
| 37          | TRANEQ  | 59    | 26    | 43    | 23    | 40    | 25    | 18    | 15    | 11    | 4     | 1     | 1     | 262    |
| 38          | MESUR   | 7     | 5     | 4     | 8     | 2     | 8     | 7     | 2     | 6     | 1     | 1     | 0     | 51     |
| 39          | MISMAN  | 7     | 9     | 7     | 5     | 7     | 10    | 6     | 3     | 2     | 1     | 0     | 0     | 57     |
| 41          | LTRANS  | 6     | 1     | 5     | 10    | 12    | 6     | 11    | 3     | 3     | 1     | 2     | 0     | 67     |
| 42          | FRTRAN  | 27    | 23    | 25    | 20    | 22    | 25    | 5     | 5     | 4     | 7     | 1     | 1     | 171    |
| 43          | POSTAL  | 0     | 4     | 2     | 1     | 2     | 2     | 2     | 1     | 0     | 0     | 0     | 1     | 16     |
| 44          | WATER   | 21    | 11    | 12    | 4     | 15    | 7     | 22    | 5     | 0     | 0     | 0     | 0     | 101    |
| 45          | AIR     | 0     | 5     | 4     | 3     | 0     | 4     | 3     | 2     | 1     | 0     | 1     | 0     | 23     |
| 46          | PIPLIN  | 0     | 0     | 0     | 0     | 3     | 1     | 0     | 0     | 0     | 0     | 0     | 0     | 4      |
| 47          | TRANS   | 4     | 3     | 2     | 0     | 2     | 2     | 2     | 2     | 0     | 1     | 0     | 0     | 18     |
| 48          | COMM    | 18    | 17    | 3     | 11    | 9     | 3     | 10    | 8     | 2     | 0     | 3     | 0     | 84     |
| 49          | ELGAS   | 15    | 12    | 13    | 9     | 18    | 16    | 10    | 4     | 6     | 1     | 2     | 1     | 107    |
| 50          | DUR     | 66    | 49    | 55    | 57    | 56    | 47    | 32    | 20    | 14    | 19    | 1     | 2     | 417    |
| 51          | NONDUR  | 33    | 24    | 17    | 28    | 22    | 8     | 21    | 6     | 10    | 3     | 3     | 0     | 175    |
| 52          | BLDMAT  | 13    | 6     | 11    | 11    | 10    | 10    | 9     | 3     | 0     | 1     | 0     | 1     | 77     |
| 53          | GRCH    | 69    | 55    | 40    | 47    | 35    | 29    | 28    | 20    | 8     | 8     | 3     | 1     | 343    |
| 54          | FOOD    | 54    | 37    | 25    | 37    | 28    | 30    | 26    | 15    | 9     | 8     | 2     | 0     | 271    |
| 55          | GASTAT  | 49    | 43    | 41    | 41    | 18    | 18    | 20    | 13    | 11    | 7     | 1     | 1     | 263    |
| 56          | APSTOR  | 20    | 19    | 14    | 17    | 27    | 13    | 16    | 8     | 8     | 5     | 3     | 0     | 149    |
| 57          | FURSTO  | 7     | 4     | 11    | 11    | 15    | 17    | 8     | 5     | 1     | 1     | 0     | 0     | 80     |
| 58          | EAT     | 37    | 49    | 73    | 91    | 69    | 37    | 45    | 28    | 17    | 12    | 12    | 0     | 530    |
| 59          | RETAIL  | 53    | 40    | 27    | 33    | 35    | 23    | 15    | 16    | 8     | 6     | 1     | 0     | 257    |
| 60          | BANK    | 22    | 15    | 10    | 17    | 8     | 15    | 8     | 6     | 4     | 2     | 0     | 0     | 102    |
| 61          | CREDIT  | 9     | 4     | 4     | 9     | 5     | 3     | 4     | 3     | 1     | 1     | 1     | 0     | 46     |
| 62          | BROKER  | 1     | 2     | 2     | 2     | 3     | 3     | 1     | 3     | 0     | 2     | 0     | 0     | 26     |
| 63          | INS     | 33    | 11    | 5     | 11    | 10    | 16    | 10    | 5     | 3     | 1     | 1     | 1     | 109    |
| 64          | INSACT  | 13    | 2     | 3     | 5     | 5     | 2     | 4     | 3     | 3     | 1     | 1     | 0     | 42     |
| 65          | RESTAT  | 27    | 29    | 21    | 29    | 37    | 31    | 32    | 10    | 16    | 5     | 3     | 1     | 251    |
| 66          | LOANS   | 4     | 0     | 6     | 0     | 0     | 1     | 0     | 1     | 1     | 0     | 0     | 0     | 13     |
| 67          | HOLD    | 7     | 2     | 1     | 7     | 2     | 5     | 2     | 1     | 1     | 1     | 0     | 0     | 29     |
| 70          | HOTEL   | 26    | 31    | 23    | 24    | 22    | 24    | 19    | 9     | 12    | 2     | 2     | 1     | 195    |
| 72          | PERSER  | 28    | 14    | 32    | 18    | 25    | 19    | 20    | 6     | 3     | 3     | 1     | 0     | 193    |
| 73          | BUSER   | 52    | 37    | 35    | 51    | 35    | 33    | 23    | 20    | 9     | 4     | 1     | 0     | 304    |
| 75          | REPAIR  | 0     | 16    | 12    | 14    | 2     | 6     | 4     | 3     | 1     | 0     | 0     | 1     | 59     |
| 76          | MISRE   | 11    | 6     | 9     | 5     | 3     | 6     | 1     | 3     | 1     | 0     | 1     | 0     | 46     |
| 77          |         | 1     | 0     | 1     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 2      |
| 78          | MOTION  | 2     | 4     | 3     | 2     | 6     | 3     | 4     | 3     | 5     | 2     | 1     | 0     | 41     |
| 79          | AMUSE   | 20    | 20    | 10    | 6     | 24    | 14    | 17    | 6     | 6     | 1     | 1     | 0     | 125    |
| 80          | HEALTH  | 109   | 62    | 65    | 55    | 24    | 30    | 26    | 19    | 13    | 5     | 1     | 0     | 413    |
| 81          | LEGAL   | 3     | 9     | 0     | 3     | 3     | 7     | 3     | 0     | 1     | 0     | 1     | 0     | 35     |
| 82          | EDUC    | 133   | 16    | 72    | 41    | 61    | 33    | 29    | 19    | 13    | 12    | 1     | 0     | 499    |
| 83          | SYCTAL  | 14    | 12    | 14    | 11    | 8     | 9     | 7     | 2     | 1     | 2     | 1     | 2     | 83     |
| 84          | ART     | 0     | 0     | 0     | 0     | 0     | 0     | 1     | 2     | 2     | 0     | 0     | 0     | 5      |
| 86          | MEMORG  | 46    | 33    | 19    | 13    | 20    | 24    | 31    | 15    | 7     | 9     | 3     | 0     | 221    |
| 88          | PHRM    | 38    | 44    | 28    | 36    | 31    | 18    | 22    | 9     | 14    | 4     | 4     | 0     | 247    |
| 89          | MISERV  | 11    | 15    | 4     | 11    | 8     | 10    | 5     | 7     | 1     | 2     | 0     | 0     | 74     |
| 90          |         | 116   | 70    | 68    | 72    | 61    | 67    | 38    | 25    | 26    | 8     | 7     | 1     | 599    |
| 97          | STATSEC | 0     | 2     | 0     | 0     | 0     | 0     | 1     | 0     | 0     | 0     | 0     | 0     | 3      |
| 99          | NONCLAS | 0     | 0     | 0     | 0     | 1     | 0     | 0     | 0     | 0     | 2     | 0     | 0     | 3      |
| TOTALS 2051 |         | 1498  | 1433  | 1454  | 1415  | 1125  | 957   | 584   | 438   | 238   | 110   | 32    | 11349 |        |

TABLE E-2 (Cont'd)

|        |         | Year 1975 |       |       |       |       |       |       |       |       |       |       |       | TOTALS |
|--------|---------|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| SIC    | IND     | 21-25     | 26-30 | 31-35 | 36-40 | 41-45 | 46-50 | 51-55 | 56-60 | 61-65 | 66-70 | 71-75 | 76-80 |        |
| 1      | AGRIC   | 32        | 35    | 32    | 64    | 64    | 59    | 67    | 51    | 30    | 19    | 8     | 1     | 468    |
| 7      | AGRSSE  | 1         | 0     | 0     | 7     | 4     | 1     | 2     | 1     | 1     | 0     | 0     | 0     | 19     |
| 9      | FISH    | 0         | 0     | 0     | 0     | 1     | 2     | 0     | 0     | 1     | 1     | 0     | 0     | 7      |
| 10     | METMI   | 0         | 0     | 0     | 2     | 1     | 0     | 0     | 2     | 0     | 0     | 0     | 0     | 5      |
| 11     | ANMIL   | 0         | 0     | 0     | 0     | 0     | 1     | 0     | 0     | 0     | 0     | 0     | 0     | 1      |
| 12     | COAL    | 1         | 1     | 2     | 3     | 2     | 3     | 2     | 2     | 3     | 0     | 2     | 0     | 21     |
| 13     | GASEX   | 1         | 0     | 3     | 5     | 5     | 9     | 6     | 0     | 2     | 0     | 0     | 1     | 35     |
| 14     | NONMET  | 0         | 0     | 4     | 0     | 4     | 4     | 1     | 1     | 2     | 0     | 0     | 0     | 16     |
| 15     | BCONST  | 4         | 4     | 7     | 12    | 32    | 32    | 37    | 41    | 30    | 2     | 1     | 0     | 202    |
| 16     | CONSTR  | 2         | 4     | 7     | 17    | 26    | 20    | 37    | 25    | 18    | 1     | 1     | 0     | 166    |
| 17     | SPCONS  | 5         | 11    | 13    | 45    | 55    | 62    | 45    | 44    | 31    | 11    | 1     | 0     | 324    |
| 19     |         | 0         | 0     | 0     | 1     | 1     | 1     | 1     | 2     | 1     | 0     | 0     | 0     | 7      |
| 20     | FOOD    | 6         | 6     | 4     | 27    | 26    | 30    | 26    | 20    | 17    | 6     | 0     | 0     | 168    |
| 21     | TAB     | 0         | 0     | 0     | 1     | 0     | 0     | 0     | 0     | 1     | 1     | 0     | 0     | 3      |
| 22     | TEXT    | 2         | 4     | 7     | 13    | 14    | 7     | 13    | 15    | 7     | 3     | 3     | 0     | 82     |
| 23     | APPARI  | 6         | 6     | 16    | 29    | 22    | 39    | 43    | 25    | 9     | 11    | 4     | 0     | 210    |
| 24     | WOOD    | 3         | 4     | 3     | 4     | 15    | 13    | 8     | 7     | 5     | 1     | 0     | 0     | 63     |
| 25     | FURN    | 4         | 1     | 6     | 6     | 8     | 10    | 10    | 5     | 4     | 1     | 0     | 0     | 55     |
| 26     | PAPER   | 0         | 0     | 4     | 3     | 8     | 9     | 5     | 6     | 5     | 1     | 0     | 0     | 45     |
| 27     | PRINT   | 3         | 0     | 6     | 17    | 11    | 12    | 19    | 11    | 13    | 5     | 2     | 0     | 101    |
| 28     | CHEM    | 1         | 0     | 1     | 3     | 0     | 15    | 9     | 8     | 6     | 3     | 1     | 0     | 55     |
| 29     | PETRO   | 0         | 0     | 0     | 0     | 2     | 0     | 1     | 3     | 2     | 0     | 0     | 0     | 8      |
| 30     | RUBBER  | 0         | 4     | 6     | 11    | 9     | 9     | 4     | 4     | 1     | 3     | 0     | 0     | 51     |
| 31     | LEATH   | 0         | 1     | 1     | 7     | 7     | 8     | 12    | 11    | 0     | 1     | 0     | 2     | 50     |
| 32     | GLASS   | 1         | 5     | 0     | 5     | 5     | 15    | 4     | 5     | 4     | 0     | 0     | 0     | 44     |
| 33     | PRIN    | 3         | 0     | 2     | 7     | 23    | 12    | 19    | 9     | 7     | 4     | 0     | 1     | 87     |
| 34     | PAINTED | 6         | 8     | 6     | 14    | 19    | 21    | 21    | 15    | 14    | 3     | 2     | 0     | 129    |
| 35     | MACH    | 4         | 3     | 2     | 29    | 28    | 19    | 37    | 24    | 19    | 0     | 2     | 0     | 167    |
| 36     | ELMACH  | 3         | 6     | 4     | 23    | 18    | 28    | 26    | 27    | 14    | 4     | 1     | 0     | 154    |
| 37     | TRANEQ  | 0         | 3     | 1     | 24    | 15    | 28    | 21    | 17    | 14    | 1     | 4     | 0     | 128    |
| 38     | MESUR   | 2         | 1     | 0     | 2     | 6     | 8     | 4     | 7     | 4     | 2     | 0     | 0     | 36     |
| 39     | MISMAN  | 1         | 1     | 2     | 5     | 12    | 3     | 5     | 5     | 5     | 1     | 0     | 1     | 41     |
| 41     | LTRANS  | 1         | 5     | 4     | 7     | 10    | 3     | 5     | 6     | 5     | 7     | 1     | 0     | 54     |
| 42     | FRTRAN  | 1         | 1     | 12    | 22    | 41    | 25    | 22    | 18    | 15    | 2     | 1     | 2     | 162    |
| 44     | WATER   | 1         | 1     | 4     | 3     | 5     | 4     | 4     | 1     | 4     | 0     | 0     | 0     | 41     |
| 45     | AIR     | 0         | 0     | 0     | 1     | 3     | 3     | 3     | 1     | 1     | 1     | 1     | 0     | 14     |
| 46     | PIPLIN  | 0         | 0     | 1     | 0     | 0     | 0     | 0     | 0     | 1     | 0     | 0     | 0     | 2      |
| 47     | TRANS   | 2         | 0     | 0     | 2     | 3     | 2     | 1     | 2     | 1     | 0     | 0     | 0     | 13     |
| 48     | COMM    | 3         | 1     | 9     | 5     | 9     | 10    | 3     | 1     | 3     | 4     | 0     | 0     | 48     |
| 49     | ELGAS   | 0         | 1     | 3     | 7     | 8     | 4     | 5     | 2     | 5     | 0     | 0     | 0     | 35     |
| 50     | DUR     | 2         | 16    | 14    | 38    | 53    | 44    | 50    | 49    | 34    | 6     | 3     | 2     | 311    |
| 51     | NONDUR  | 2         | 7     | 4     | 6     | 15    | 14    | 3     | 9     | 4     | 0     | 1     | 0     | 65     |
| 52     | BLDMAT  | 1         | 3     | 0     | 7     | 14    | 5     | 8     | 3     | 4     | 1     | 1     | 0     | 47     |
| 53     | GMERCH  | 12        | 9     | 10    | 28    | 29    | 25    | 17    | 35    | 18    | 11    | 1     | 1     | 196    |
| 54     | FOOD    | 7         | 7     | 5     | 32    | 28    | 25    | 28    | 26    | 15    | 4     | 4     | 2     | 183    |
| 55     | GASTAT  | 5         | 9     | 5     | 21    | 34    | 32    | 28    | 21    | 15    | 8     | 3     | 0     | 181    |
| 56     | APSTOR  | 3         | 5     | 5     | 9     | 8     | 8     | 22    | 26    | 11    | 10    | 6     | 2     | 115    |
| 57     | FURSTO  | 1         | 0     | 1     | 1     | 9     | 6     | 4     | 7     | 4     | 2     | 0     | 0     | 35     |
| 58     | EAT     | 10        | 35    | 30    | 62    | 78    | 58    | 56    | 60    | 31    | 12    | 5     | 2     | 439    |
| 59     | RETAIL  | 4         | 1     | 6     | 23    | 17    | 18    | 21    | 27    | 19    | 3     | 0     | 0     | 139    |
| 60     | BANK    | 5         | 2     | 0     | 12    | 8     | 22    | 7     | 7     | 8     | 2     | 1     | 0     | 74     |
| 61     | CREDIT  | 1         | 0     | 0     | 2     | 3     | 3     | 2     | 3     | 0     | 1     | 2     | 0     | 17     |
| 62     | BROKER  | 0         | 0     | 0     | 2     | 2     | 2     | 1     | 1     | 0     | 1     | 0     | 0     | 9      |
| 63     | INS     | 1         | 7     | 2     | 19    | 15    | 5     | 2     | 16    | 5     | 1     | 1     | 0     | 84     |
| 64     | INSACT  | 2         | 1     | 1     | 2     | 13    | 1     | 5     | 1     | 3     | 1     | 0     | 0     | 30     |
| 65     | RESTAT  | 2         | 3     | 6     | 19    | 29    | 16    | 13    | 15    | 22    | 7     | 4     | 0     | 136    |
| 66     | LOANS   | 0         | 0     | 0     | 2     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 2      |
| 67     | HOLD    | 0         | 0     | 0     | 1     | 4     | 1     | 1     | 2     | 0     | 0     | 0     | 0     | 9      |
| 70     | HOTEL   | 8         | 11    | 13    | 20    | 32    | 35    | 22    | 28    | 12    | 6     | 3     | 4     | 194    |
| 72     | PERSER  | 4         | 4     | 10    | 12    | 23    | 25    | 20    | 14    | 15    | 4     | 3     | 0     | 134    |
| 73     | BUSER   | 13        | 13    | 27    | 26    | 46    | 49    | 41    | 30    | 27    | 5     | 4     | 1     | 282    |
| 75     | REPAIR  | 2         | 3     | 1     | 6     | 8     | 5     | 3     | 3     | 0     | 2     | 0     | 0     | 33     |
| 76     | MISRE   | 1         | 0     | 0     | 1     | 4     | 9     | 3     | 2     | 4     | 1     | 0     | 0     | 25     |
| 78     | MOTION  | 6         | 2     | 0     | 5     | 6     | 6     | 6     | 1     | 2     | 0     | 0     | 0     | 34     |
| 79     | AMUSE   | 7         | 3     | 2     | 19    | 18    | 14    | 12    | 3     | 8     | 2     | 0     | 0     | 82     |
| 80     | HEALTH  | 6         | 14    | 30    | 61    | 69    | 47    | 56    | 43    | 15    | 15    | 3     | 2     | 363    |
| 81     | LEGAL   | 0         | 0     | 2     | 5     | 5     | 2     | 7     | 1     | 2     | 0     | 0     | 0     | 28     |
| 82     | EDUC    | 11        | 19    | 26    | 54    | 72    | 64    | 47    | 35    | 32    | 16    | 2     | 0     | 378    |
| 83     | SOCIAL  | 2         | 4     | 4     | 3     | 6     | 7     | 9     | 5     | 3     | 2     | 0     | 0     | 45     |
| 86     | MENORG  | 6         | 4     | 3     | 13    | 33    | 11    | 14    | 19    | 10    | 4     | 2     | 3     | 122    |
| 88     | PRIME   | 1         | 4     | 4     | 11    | 26    | 19    | 24    | 50    | 19    | 6     | 3     | 1     | 168    |
| 89     | MISERV  | 3         | 3     | 1     | 5     | 10    | 3     | 6     | 12    | 2     | 2     | 1     | 1     | 49     |
| 90     |         | 16        | 10    | 12    | 39    | 50    | 39    | 51    | 35    | 31    | 8     | 0     | 3     | 294    |
| 97     | KATSEC  | 0         | 0     | 0     | 2     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 2      |
| 99     | NONCLAS | 1         | 0     | 0     | 0     | 1     | 0     | 1     | 0     | 0     | 0     | 0     | 0     | 3      |
| TOTALS |         | 244       | 322   | 406   | 1005  | 1214  | 1161  | 1130  | 1013  | 680   | 242   | 88    | 32    | 7637   |

TABLE E-3  
AGE DISTRIBUTION BY INDUSTRY: 1957 AND 1975

Year 1957

| SIC    | IND     | 21-25 | 26-30 | 31-35 | 36-40 | 41-45 | 46-50 | 51-55 | 56-60 | 61-65 | 66-70 | 71-75 | 76-80 | TOTALS |
|--------|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 1      | AGRIC   | 27    | 14    | 11    | 10    | 10    | 7     | 6     | 5     | 3     | 1     | 1     | 0     | 100    |
| 7      | AGRS    | 11    | 22    | 2     | 31    | 8     | 5     | 11    | 0     | 2     | 2     | 0     | 0     | 100    |
| 9      | FISH    | 0     | 40    | 40    | 0     | 20    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 100    |
| 10     | METMI   | 20    | 25    | 0     | 6     | 13    | 13    | 6     | 0     | 0     | 0     | 0     | 0     | 100    |
| 11     | AMTL    | 0     | 20    | 0     | 0     | 20    | 60    | 0     | 0     | 0     | 0     | 0     | 0     | 100    |
| 12     | COAL    | 25    | 3     | 7     | 0     | 25    | 10    | 10    | 7     | 10    | 0     | 0     | 0     | 100    |
| 13     | CASEX   | 9     | 27    | 34    | 6     | 8     | 4     | 1     | 5     | 0     | 1     | 0     | 0     | 100    |
| 14     | NONMET  | 32    | 8     | 12    | 16    | 12    | 8     | 2     | 4     | 0     | 0     | 0     | 0     | 100    |
| 15     | BCONST  | 9     | 5     | 16    | 14    | 20    | 8     | 9     | 5     | 6     | 1     | 1     | 0     | 100    |
| 16     | CONSRT  | 0     | 12    | 14    | 17    | 14    | 8     | 10    | 6     | 3     | 1     | 0     | 0     | 100    |
| 17     | SPCONS  | 13    | 7     | 16    | 15    | 14    | 10    | 11    | 2     | 3     | 2     | 1     | 0     | 100    |
| 19     |         | 28    | 7     | 0     | 57    | 0     | 7     | 0     | 0     | 0     | 0     | 0     | 0     | 100    |
| 20     | FOOD    | 16    | 13    | 6     | 19    | 10    | 10    | 6     | 6     | 4     | 2     | 0     | 0     | 100    |
| 21     | TAB     | 37    | 0     | 25    | 12    | 12    | 0     | 0     | 0     | 0     | 12    | 0     | 0     | 100    |
| 22     | TEXT    | 14    | 4     | 17    | 12    | 14    | 14    | 8     | 6     | 3     | 0     | 0     | 0     | 100    |
| 23     | APPARL  | 14    | 15    | 13    | 11    | 2     | 13    | 7     | 8     | 3     | 1     | 0     | 2     | 100    |
| 24     | WOOD    | 17    | 15    | 17    | 10    | 11    | 15    | 4     | 4     | 0     | 3     | 0     | 0     | 100    |
| 25     | FURN    | 13    | 10    | 10    | 22    | 12    | 13    | 9     | 4     | 2     | 0     | 0     | 0     | 100    |
| 26     | PAPER   | 9     | 13    | 11    | 11    | 15    | 13    | 5     | 7     | 1     | 1     | 5     | 0     | 100    |
| 27     | PRINT   | 17    | 8     | 7     | 8     | 20    | 12    | 10    | 5     | 4     | 2     | 1     | 0     | 100    |
| 28     | CHEM    | 13    | 15    | 6     | 11    | 16    | 13    | 6     | 5     | 4     | 4     | 0     | 0     | 100    |
| 29     | PETRO   | 9     | 22    | 9     | 18    | 9     | 4     | 4     | 13    | 4     | 4     | 0     | 0     | 100    |
| 30     | RUBBER  | 16    | 27    | 14    | 9     | 3     | 3     | 6     | 1     | 8     | 4     | 1     | 0     | 100    |
| 31     | LEATH   | 13    | 6     | 10    | 20    | 13    | 8     | 9     | 10    | 2     | 2     | 0     | 0     | 100    |
| 32     | GLASS   | 17    | 10    | 14    | 7     | 10    | 10    | 9     | 9     | 7     | 2     | 0     | 0     | 100    |
| 33     | PRIM    | 16    | 11    | 9     | 16    | 14    | 9     | 8     | 6     | 3     | 2     | 1     | 0     | 100    |
| 34     | FABMET  | 14    | 11    | 15    | 10    | 16    | 12    | 8     | 3     | 7     | 1     | 0     | 0     | 100    |
| 35     | MACH    | 19    | 8     | 8     | 15    | 10    | 11    | 8     | 4     | 9     | 2     | 0     | 0     | 100    |
| 36     | ELMACH  | 21    | 14    | 15    | 9     | 11    | 10    | 6     | 4     | 1     | 3     | 0     | 0     | 100    |
| 37     | TRANEQ  | 19    | 9     | 16    | 10    | 15    | 9     | 6     | 5     | 4     | 1     | 0     | 0     | 100    |
| 38     | MESUR   | 13    | 9     | 7     | 15    | 3     | 15    | 13    | 3     | 11    | 1     | 1     | 0     | 100    |
| 39     | MISMAN  | 12    | 15    | 12    | 8     | 12    | 17    | 10    | 5     | 3     | 1     | 0     | 0     | 100    |
| 41     | LTRANS  | 8     | 11    | 7     | 14    | 17    | 8     | 16    | 4     | 4     | 1     | 2     | 0     | 100    |
| 42     | FRTRAN  | 15    | 13    | 14    | 11    | 16    | 14    | 2     | 2     | 2     | 4     | 0     | 0     | 100    |
| 43     | POSTAL  | 0     | 25    | 12    | 6     | 18    | 12    | 12    | 6     | 0     | 0     | 0     | 0     | 100    |
| 44     | WATER   | 20    | 10    | 11    | 3     | 18    | 6     | 21    | 4     | 0     | 0     | 0     | 0     | 100    |
| 45     | AIR     | 0     | 21    | 17    | 13    | 0     | 17    | 13    | 8     | 4     | 0     | 4     | 0     | 100    |
| 46     | PIPLIN  | 0     | 0     | 0     | 0     | 75    | 25    | 0     | 0     | 0     | 0     | 0     | 0     | 100    |
| 47     | TRANS   | 22    | 16    | 11    | 0     | 11    | 11    | 11    | 11    | 0     | 5     | 0     | 0     | 100    |
| 48     | CC-MN   | 21    | 20    | 3     | 13    | 10    | 3     | 11    | 9     | 2     | 0     | 3     | 0     | 100    |
| 49     | ELGAS   | 14    | 11    | 12    | 8     | 16    | 14    | 9     | 3     | 5     | 0     | 1     | 0     | 100    |
| 50     | DUR     | 15    | 11    | 13    | 13    | 13    | 11    | 7     | 4     | 3     | 4     | 0     | 0     | 100    |
| 51     | NONDUR  | 18    | 13    | 9     | 16    | 12    | 4     | 12    | 3     | 5     | 1     | 1     | 0     | 100    |
| 52     | BLDMAT  | 19    | 7     | 14    | 14    | 12    | 12    | 11    | 3     | 0     | 1     | 0     | 1     | 100    |
| 53     | CMERCH  | 20    | 16    | 11    | 13    | 10    | 8     | 8     | 5     | 2     | 2     | 0     | 0     | 100    |
| 54     | FOOD    | 19    | 13    | 9     | 13    | 10    | 11    | 9     | 5     | 3     | 2     | 0     | 0     | 100    |
| 55     | GASTAT  | 18    | 16    | 15    | 15    | 6     | 6     | 7     | 4     | 4     | 2     | 0     | 0     | 100    |
| 56     | APSTOR  | 13    | 12    | 9     | 11    | 18    | 8     | 10    | 5     | 5     | 3     | 2     | 0     | 100    |
| 57     | FURSTO  | 8     | 5     | 13    | 13    | 18    | 21    | 10    | 6     | 1     | 1     | 0     | 0     | 100    |
| 58     | ZAT     | 18    | 9     | 13    | 17    | 13    | 6     | 8     | 5     | 3     | 2     | 2     | 0     | 100    |
| 59     | RETAIL  | 20    | 15    | 10    | 12    | 13    | 8     | 5     | 5     | 3     | 1     | 0     | 0     | 100    |
| 60     | BANK    | 21    | 14    | 9     | 11    | 7     | 14    | 7     | 5     | 3     | 1     | 0     | 0     | 100    |
| 61     | CREDIT  | 19    | 13    | 8     | 19    | 10    | 6     | 8     | 6     | 2     | 2     | 2     | 0     | 100    |
| 62     | BROKER  | 3     | 14    | 7     | 7     | 11    | 11    | 3     | 11    | 0     | 7     | 0     | 0     | 100    |
| 63     | INS     | 30    | 11    | 4     | 10    | 9     | 14    | 9     | 4     | 2     | 0     | 0     | 0     | 100    |
| 64     | INSAGT  | 30    | 4     | 7     | 11    | 11    | 4     | 9     | 7     | 7     | 2     | 2     | 0     | 100    |
| 65     | RESTAT  | 10    | 11    | 12    | 11    | 14    | 12    | 12    | 3     | 6     | 1     | 1     | 0     | 100    |
| 66     | LOANS   | 30    | 0     | 46    | 0     | 0     | 7     | 0     | 7     | 7     | 0     | 0     | 0     | 100    |
| 67     | HOLD    | 24    | 6     | 3     | 24    | 6     | 17    | 6     | 3     | 3     | 0     | 0     | 0     | 100    |
| 70     | HOTEL   | 13    | 15    | 11    | 12    | 11    | 12    | 9     | 4     | 6     | 1     | 1     | 0     | 100    |
| 72     | PERSER  | 14    | 19    | 16    | 9     | 12    | 9     | 10    | 3     | 1     | 1     | 0     | 0     | 100    |
| 73     | BUSER   | 17    | 12    | 11    | 16    | 12    | 10    | 7     | 6     | 2     | 1     | 0     | 0     | 100    |
| 75     | REPAIR  | 0     | 27    | 20    | 23    | 3     | 10    | 6     | 5     | 1     | 0     | 0     | 1     | 100    |
| 76     | MISRE   | 23    | 13    | 19    | 10    | 6     | 13    | 2     | 6     | 2     | 0     | 2     | 0     | 100    |
| 77     |         | 50    | 0     | 50    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 100    |
| 78     | MOTION  | 19    | 9     | 7     | 4     | 14    | 7     | 9     | 7     | 12    | 4     | 2     | 0     | 100    |
| 79     | AMUSE   | 16    | 16    | 8     | 4     | 19    | 11    | 13    | 4     | 4     | 0     | 0     | 0     | 100    |
| 80     | HEALTH  | 26    | 15    | 15    | 13    | 6     | 7     | 6     | 4     | 3     | 1     | 0     | 0     | 100    |
| 81     | LEGAL   | 22    | 25    | 0     | 8     | 8     | 20    | 2     | 0     | 2     | 0     | 2     | 0     | 100    |
| 82     | EDUC    | 26    | 17    | 14    | 8     | 12    | 6     | 5     | 3     | 2     | 2     | 0     | 0     | 100    |
| 83     | SOCIAL  | 16    | 14    | 16    | 13    | 9     | 10    | 2     | 2     | 1     | 2     | 1     | 2     | 100    |
| 84     | ART     | 0     | 0     | 0     | 0     | 0     | 0     | 20    | 40    | 40    | 0     | 0     | 0     | 100    |
| 86     | MEMORG  | 20    | 14    | 8     | 5     | 9     | 10    | 14    | 7     | 3     | 4     | 1     | 0     | 100    |
| 88     | PRIMA   | 15    | 17    | 11    | 14    | 12    | 7     | 8     | 3     | 5     | 1     | 1     | 0     | 100    |
| 89     | MISERV  | 14    | 20    | 5     | 14    | 10    | 13    | 6     | 9     | 1     | 2     | 0     | 0     | 100    |
| 90     |         | 19    | 11    | 14    | 12    | 13    | 11    | 6     | 4     | 4     | 1     | 1     | 0     | 100    |
| 97     | NATSEC  | 0     | 66    | 0     | 0     | 0     | 0     | 33    | 0     | 0     | 0     | 0     | 0     | 100    |
| 99     | NONCLAS | 0     | 0     | 0     | 0     | 33    | 0     | 0     | 0     | 0     | 66    | 0     | 0     | 100    |
| TOTALS |         | 16    | 33    | 12    | 12    | 12    | 10    | 0     | 5     | 3     | 2     | 0     | 0     | 100    |



TABLE E-3 (Cont'd)

|        |         | Year 1975 |       |       |       |       |       |       |       |       |       |       |       | TOTALS |
|--------|---------|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| SIC    | IND     | 21-25     | 26-30 | 31-35 | 36-40 | 41-45 | 46-50 | 51-55 | 56-60 | 61-65 | 66-70 | 71-75 | 76-80 |        |
| 1      | AGRIC   | 6         | 8     | 6     | 13    | 14    | 12    | 14    | 10    | 6     | 4     | 1     | 0     | 100    |
| 7      | AGRISE  | 5         | 0     | 0     | 36    | 21    | 15    | 10    | 5     | 5     | 0     | 0     | 0     | 100    |
| 9      | FISH    | 0         | 0     | 0     | 0     | 14    | 28    | 28    | 0     | 14    | 14    | 0     | 0     | 100    |
| 10     | MEIMI   | 0         | 0     | 0     | 40    | 20    | 0     | 0     | 40    | 0     | 0     | 0     | 0     | 100    |
| 11     | ANIMI   | 0         | 0     | 0     | 0     | 0     | 100   | 0     | 0     | 0     | 0     | 0     | 0     | 100    |
| 12     | COAL    | 4         | 4     | 9     | 14    | 9     | 14    | 9     | 9     | 14    | 0     | 9     | 0     | 100    |
| 13     | GASEX   | 2         | 0     | 0     | 22    | 14    | 25    | 17    | 0     | 5     | 0     | 0     | 2     | 100    |
| 14     | NONMET  | 0         | 0     | 25    | 0     | 25    | 25    | 6     | 6     | 12    | 0     | 0     | 0     | 100    |
| 15     | BCONST  | 1         | 1     | 3     | 5     | 15    | 15    | 12    | 20    | 14    | 0     | 0     | 0     | 100    |
| 16     | CONSTR  | 1         | 2     | 4     | 10    | 15    | 16    | 22    | 15    | 10    | 0     | 0     | 0     | 100    |
| 17     | SPOONS  | 1         | 3     | 4     | 14    | 16    | 19    | 13    | 13    | 9     | 3     | 0     | 0     | 100    |
| 19     |         | 0         | 0     | 0     | 14    | 14    | 14    | 14    | 28    | 14    | 0     | 0     | 0     | 100    |
| 20     | FOOD    | 3         | 3     | 2     | 16    | 15    | 17    | 15    | 11    | 10    | 3     | 0     | 0     | 100    |
| 21     | TAB     | 0         | 0     | 0     | 33    | 0     | 0     | 0     | 0     | 33    | 33    | 0     | 0     | 100    |
| 22     | TEXT    | 2         | 4     | 7     | 14    | 15    | 7     | 14    | 17    | 7     | 3     | 3     | 0     | 100    |
| 23     | APPARL  | 2         | 2     | 7     | 13    | 10    | 18    | 20    | 11    | 4     | 5     | 1     | 0     | 100    |
| 24     | WOOD    | 4         | 6     | 4     | 6     | 23    | 20    | 12    | 11    | 7     | 1     | 0     | 0     | 100    |
| 25     | FURN    | 7         | 1     | 10    | 10    | 14    | 18    | 18    | 9     | 7     | 1     | 0     | 0     | 100    |
| 26     | PAPER   | 0         | 0     | 8     | 6     | 17    | 20    | 20    | 13    | 11    | 2     | 0     | 0     | 100    |
| 27     | PRINT   | 2         | 0     | 5     | 16    | 12    | 11    | 18    | 10    | 12    | 4     | 1     | 0     | 100    |
| 28     | CHEM    | 1         | 0     | 1     | 5     | 14    | 27    | 16    | 14    | 10    | 5     | 1     | 0     | 100    |
| 29     | PETRO   | 0         | 0     | 0     | 0     | 25    | 0     | 12    | 37    | 25    | 0     | 0     | 0     | 100    |
| 30     | RUBBER  | 0         | 7     | 11    | 21    | 17    | 17    | 7     | 7     | 1     | 5     | 0     | 0     | 100    |
| 31     | LEATH   | 0         | 2     | 2     | 14    | 14    | 16    | 24    | 22    | 0     | 2     | 0     | 4     | 100    |
| 32     | GLASS   | 2         | 11    | 0     | 11    | 11    | 34    | 9     | 11    | 9     | 0     | 0     | 0     | 100    |
| 33     | PRIN    | 3         | 0     | 2     | 8     | 26    | 13    | 21    | 10    | 8     | 4     | 0     | 1     | 100    |
| 34     | FABMET  | 4         | 6     | 4     | 10    | 14    | 16    | 16    | 11    | 10    | 2     | 1     | 0     | 100    |
| 35     | MACH    | 2         | 1     | 1     | 17    | 16    | 11    | 22    | 14    | 11    | 0     | 1     | 0     | 100    |
| 36     | ELMACH  | 1         | 3     | 2     | 14    | 11    | 18    | 16    | 17    | 9     | 2     | 0     | 0     | 100    |
| 37     | TRANEQ  | 0         | 2     | 0     | 18    | 11    | 21    | 16    | 13    | 10    | 0     | 3     | 0     | 100    |
| 38     | MESUR   | 5         | 2     | 0     | 5     | 16    | 22    | 11    | 19    | 11    | 5     | 0     | 0     | 100    |
| 39     | MISMAN  | 2         | 2     | 4     | 12    | 29    | 7     | 12    | 12    | 12    | 2     | 0     | 2     | 100    |
| 41     | LTRANS  | 1         | 9     | 7     | 12    | 18    | 5     | 9     | 11    | 9     | 12    | 1     | 0     | 100    |
| 42     | FRTRAN  | 0         | 0     | 7     | 13    | 25    | 15    | 13    | 11    | 9     | 1     | 0     | 1     | 100    |
| 44     | WATER   | 2         | 2     | 34    | 7     | 21    | 9     | 9     | 2     | 9     | 0     | 0     | 0     | 100    |
| 45     | AIR     | 0         | 0     | 0     | 7     | 21    | 21    | 7     | 7     | 7     | 7     | 7     | 0     | 100    |
| 46     | PIPLIN  | 0         | 0     | 50    | 0     | 0     | 0     | 0     | 0     | 50    | 0     | 0     | 0     | 100    |
| 47     | TRANS   | 15        | 0     | 0     | 15    | 23    | 15    | 7     | 15    | 7     | 0     | 0     | 0     | 100    |
| 48     | COMM    | 6         | 2     | 18    | 10    | 18    | 20    | 6     | 2     | 6     | 8     | 0     | 0     | 100    |
| 49     | ELGAS   | 0         | 2     | 0     | 20    | 22    | 11    | 14    | 5     | 14    | 0     | 0     | 0     | 100    |
| 50     | DUR     | 0         | 5     | 4     | 12    | 17    | 14    | 16    | 15    | 10    | 0     | 0     | 0     | 100    |
| 51     | NONDUR  | 3         | 10    | 6     | 9     | 23    | 21    | 4     | 13    | 6     | 0     | 1     | 0     | 100    |
| 52     | BLOMAT  | 2         | 6     | 0     | 14    | 29    | 18    | 17    | 6     | 0     | 2     | 2     | 0     | 100    |
| 53     | CNERCH  | 6         | 4     | 5     | 14    | 14    | 12    | 8     | 17    | 9     | 5     | 0     | 0     | 100    |
| 54     | FOOD    | 3         | 3     | 2     | 17    | 15    | 13    | 15    | 14    | 8     | 2     | 2     | 1     | 100    |
| 55     | GASTAT  | 2         | 4     | 2     | 11    | 18    | 17    | 15    | 11    | 8     | 4     | 1     | 0     | 100    |
| 56     | APSTOR  | 2         | 4     | 4     | 7     | 6     | 6     | 19    | 22    | 9     | 8     | 5     | 1     | 100    |
| 57     | FURSTO  | 2         | 0     | 2     | 2     | 25    | 17    | 11    | 20    | 11    | 5     | 0     | 0     | 100    |
| 58     | EAT     | 2         | 7     | 6     | 14    | 17    | 13    | 12    | 13    | 7     | 2     | 1     | 0     | 100    |
| 59     | RETAIL  | 2         | 0     | 4     | 16    | 12    | 12    | 15    | 19    | 13    | 2     | 0     | 0     | 100    |
| 60     | BANK    | 6         | 2     | 0     | 16    | 10    | 29    | 9     | 9     | 10    | 2     | 1     | 0     | 100    |
| 61     | CREDIT  | 5         | 0     | 0     | 11    | 17    | 17    | 11    | 17    | 0     | 5     | 11    | 0     | 100    |
| 62     | BROKER  | 0         | 0     | 0     | 22    | 22    | 22    | 11    | 11    | 0     | 11    | 0     | 0     | 100    |
| 63     | INS     | 1         | 8     | 2     | 22    | 22    | 5     | 9     | 19    | 5     | 1     | 1     | 0     | 100    |
| 64     | INSAGI  | 6         | 3     | 3     | 6     | 43    | 3     | 16    | 3     | 10    | 3     | 0     | 0     | 100    |
| 65     | RESTAT  | 1         | 2     | 4     | 13    | 21    | 11    | 9     | 11    | 16    | 5     | 2     | 0     | 100    |
| 66     | LOANS   | 0         | 0     | 0     | 100   | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 100    |
| 67     | HOLD    | 0         | 0     | 0     | 11    | 44    | 11    | 11    | 22    | 0     | 0     | 0     | 0     | 100    |
| 70     | HOTEL   | 4         | 5     | 6     | 10    | 16    | 18    | 11    | 14    | 6     | 3     | 1     | 2     | 100    |
| 72     | PERSER  | 2         | 2     | 7     | 8     | 17    | 18    | 14    | 10    | 11    | 2     | 2     | 0     | 100    |
| 73     | BUSER   | 4         | 4     | 9     | 9     | 16    | 17    | 14    | 10    | 9     | 1     | 1     | 0     | 100    |
| 75     | REPAIR  | 6         | 9     | 3     | 18    | 24    | 15    | 9     | 9     | 0     | 6     | 0     | 0     | 100    |
| 76     | MISRE   | 4         | 0     | 0     | 4     | 16    | 36    | 12    | 8     | 16    | 4     | 0     | 0     | 100    |
| 78     | MOTION  | 17        | 5     | 0     | 14    | 17    | 17    | 17    | 2     | 5     | 0     | 0     | 0     | 100    |
| 79     | AMUSE   | 7         | 3     | 2     | 21    | 20    | 15    | 13    | 3     | 9     | 2     | 0     | 0     | 100    |
| 80     | HEALTH  | 1         | 4     | 8     | 16    | 19    | 12    | 15    | 11    | 4     | 4     | 0     | 0     | 100    |
| 81     | LEGAL   | 0         | 0     | 7     | 17    | 32    | 7     | 25    | 3     | 7     | 0     | 0     | 0     | 100    |
| 82     | EDUC    | 2         | 5     | 6     | 14    | 19    | 16    | 12    | 9     | 8     | 4     | 0     | 0     | 100    |
| 83     | SOCIAL  | 4         | 0     | 8     | 6     | 13    | 15    | 20    | 11    | 6     | 4     | 0     | 0     | 100    |
| 86     | MEMORC  | 4         | 3     | 2     | 10    | 27    | 9     | 11    | 15    | 8     | 3     | 1     | 2     | 100    |
| 88     | PRINH   | 0         | 2     | 2     | 6     | 15    | 11    | 14    | 29    | 11    | 3     | 1     | 0     | 100    |
| 89     | MISERV  | 6         | 6     | 2     | 10    | 20    | 6     | 12    | 24    | 4     | 4     | 2     | 2     | 100    |
| 90     |         | 5         | 1     | 4     | 13    | 17    | 13    | 17    | 11    | 10    | 2     | 0     | 1     | 100    |
| 97     | KATSEC  | 0         | 0     | 0     | 100   | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 100    |
| 99     | NONCLAS | 33        | 0     | 0     | 0     | 33    | 0     | 33    | 0     | 0     | 0     | 0     | 0     | 100    |
| TOTALS |         | 3         | 4     | 5     | 13    | 17    | 15    | 14    | 13    | 8     | 3     | 1     | 0     | 100    |

TABLE E-4

INDUSTRIES WITH HIGHEST PERCENTAGE  
OF WORKERS OVER 45 (1957)

| <u>SIC</u> | <u>Industry</u>   | <u>Percent<br/>over 45</u> | <u>Percent<br/>over 60</u> | <u>No. in<br/>sample</u> |
|------------|---|----------------------------|----------------------------|--------------------------|
| 57         | Furniture, home furnishing, and<br>equipment stores                       | 57                         | 8                          | 80                       |
| 78         | Motion pictures   | 55                         | 25                         | 41                       |
| 27         | Printing, publishing, and<br>allied industries                            | 54                         | 12                         | 157                      |
| 41         | Local suburban transit and interurban<br>highway passenger transportation | 52                         | 11                         | 67                       |
| 56         | Apparel and accessory stores  | 51                         | 15                         | 149                      |
| 26         | Paper and allied products   | 51                         | 14                         | 53                       |
|            | Amusement and recreation services,<br>except motion pictures              | 51                         | 8                          | 125                      |
| 15         | Building construction   | 50                         | 13                         | 292                      |
| 65         | Real estate   | 49                         | 11                         | 251                      |
| 44         | Water transportation  | 49                         | 4                          | 107                      |
| 49         | Electric gas and sanitary services  | 48                         | 9                          | 107                      |
| 39         | Misc. manufacturing industries  | 48                         | 9                          | 57                       |
| 28         | Chemicals and allied products   | 48                         | 13                         | 123                      |
| 86         | Membership organization   | 48                         | 15                         | 221                      |
| 38         | Measuring, analyzing, and<br>controlling instruments                      | 47                         | 16                         | 51                       |
| 34         | Fabricated metal products, except<br>machinery and transportation equip.  | 47                         | 11                         | 197                      |
| 32         | Stone, clay, glass, and concrete<br>products                              | 47                         | 18                         | 94                       |
| 22         | Textile mill products   | 45                         | 9                          | 130                      |
| 31         | Leather and leather products  | 44                         | 14                         | 73                       |

TABLE E-4 (Cont'd)

|    |  |    |    |     |
|----|--|----|----|-----|
| 70 | Hotels, rooming houses, camps,<br>and other lodging places                   | 44 | 12 | 195 |
| 33 | Primary metal industries   | 43 | 12 | 184 |
| 17 | Construction, special trade<br>contractors                                   | 43 | 8  | 427 |
| 64 | Insurance agents, brokers, and<br>service                                    | 42 | 18 | 42  |
| 23 | Apparel and other finished products<br>made from fabric and similar material | 42 | 14 | 299 |
| 16 | Construction other than building   | 42 | 10 | 262 |
| 50 | Wholesale trade, durable goods   | 42 | 11 | 417 |
| 89 | Miscellaneous services   | 41 | 12 | 74  |
| 42 | Motor freight transportation and<br>warehousing                              | 40 | 8  | 171 |
| 25 | Furniture and fixtures   | 40 | 6  | 74  |
| 54 | Food stores  | 40 | 10 | 271 |
| 52 | Building materials, hardware,<br>garden supplies, mobile home<br>dealers     |    |    |     |
| 37 | Transportation equipment   | 48 | 10 | 262 |
| 81 | Legal services   | 40 | 4  | 35  |
| 90 |  | 40 | 10 | 599 |
| 51 | Wholesale trade, nondurable goods  | 39 | 11 | 175 |
| 58 | Eating and drinking places   | 39 | 12 | 530 |
| 20 | Food and kindred products  | 38 | 12 | 259 |
| 63 | Insurance  | 38 | 6  | 109 |
| 73 | Business services  | 38 | 9  | 304 |
| 48 | Communication  | 38 | 14 | 84  |
| 60 | Banking  | 37 | 8  | 102 |

TABLE E-4 (Cont'd)

|    |  |    |    |     |
|----|--|----|----|-----|
| 24 | Lumber and wood products<br>except furniture               | 37 | 7  | 86  |
| 88 | Private households   | 37 | 10 | 247 |
| 59 | Miscellaneous retail                                       | 37 | 11 | 257 |
| 61 | Credit agencies other than banks                           | 36 | 12 | 46  |
| 72 | Personal services  | 36 | 5  | 193 |
| 83 | Social services  | 35 | 8  | 83  |
| 36 | Electrical and electrical<br>machinery, equipment supplies | 35 | 8  | 231 |
| 53 | General merchandise stores                                 | 35 | 9  | 343 |
| 1  | Agriculture production crops                               | 33 | 10 | 650 |
| 76 | Miscellaneous repair services                              | 31 | 10 | 46  |
| 82 | Educational services                                       | 30 | 7  | 499 |
| 55 | Automotive dealers and gas<br>service stations             | 29 | 10 | 263 |
| 7  | Agricultural services                                      | 28 | 4  | 35  |
| 80 | Health services  | 27 | 8  | 413 |
| 30 | Rubber and miscellaneous plastic<br>products               | 26 | 14 | 61  |
| 75 | Automotive repair, services<br>and garages                 | 26 | 7  | 59  |
| 13 | Oil and gas extraction                                     | 19 | 6  | 72  |

TABLE E-5

INDUSTRIES WITH HIGHEST PERCENTAGE  
OF WORKERS OVER 45 (1975)

| <u>SIC</u> | <u>Industry</u>   | <u>Percent<br/>over 45</u> | <u>Percent<br/>over 60</u> | <u>No. in<br/>sample</u> |
|------------|---|----------------------------|----------------------------|--------------------------|
| 57         | Furniture, home furnishings<br>and equipment stores   | 89                         | 36                         | 350                      |
| 28         | Chemicals and allied products   | 87                         | 30                         | 55                       |
| 38         | Measuring, analyzing, and controlling<br>instruments, photographs, medical<br>and optical goods, watches,<br>and clocks | 84                         | 35                         | 36                       |
| 88         | Private households  | 84                         | 44                         | 168                      |
| 26         | Paper and allied products   | 83                         | 26                         | 45                       |
| 33         | Primary metal industries  | 83                         | 23                         | 87                       |
| 15         | Building construction   | 82                         | 34                         | 202                      |
| 31         | Leather and leather products  | 82                         | 28                         | 50                       |
| 64         | Insurance agents, brokers<br>and service  | 78                         | 16                         | 30                       |
| 86         | Membership organizations  | 76                         | 29                         | 122                      |
| 39         | Miscellaneous manufacturing<br>industries   | 76                         | 28                         | 41                       |
| 56         | Apparel and accessory stores  | 76                         | 45                         | 115                      |
| 35         | Machinery, except electrical  | 75                         | 26                         | 167                      |
| 42         | Motor freight transportation<br>and warehousing   | 75                         | 22                         | 162                      |
| 65         | Real estate   | 75                         | 34                         | 136                      |
| 37         | Transportation equipment  | 74                         | 26                         | 128                      |
| 32         | Stone, clay, glass, and concrete<br>products  | 74                         | 20                         | 44                       |

TABLE E-5 (Cont'd)

|    |   |    |    |     |
|----|---|----|----|-----|
| 52 | Building materials, hardware,<br>garden supplies, and mobile<br>home dealers      | 74 | 18 | 47  |
| 24 | Lumber and wood products, except<br>furniture                                     | 74 | 19 | 63  |
| 89 | Miscellaneous services  | 74 | 36 | 49  |
| 72 | Personal services   | 74 | 25 | 134 |
| 55 | Automotive dealers, gas service<br>stations                                       | 74 | 24 | 181 |
| 36 | Electrical and electronic<br>machinery, equipment, supplies                       | 73 | 28 | 154 |
| 17 | Construction, special trade<br>contractors  | 73 | 25 | 324 |
| 50 | Wholesale trade, durable goods  | 73 | 26 | 311 |
| 59 | Miscellaneous retail  | 73 | 34 | 139 |
| 70 | Hotels, rooming houses, camps<br>and other lodging places                         | 71 | 26 | 194 |
| 90 |   |    |    |     |
| 20 | Food and kindred products   | 71 | 24 | 168 |
| 60 | Banking   | 70 | 22 | 74  |
| 34 | Fabricated metal products, except<br>machinery and transportation<br>equipment    | 70 | 24 | 129 |
| 54 | Food stores   | 70 | 27 | 183 |
| 23 | Apparel and other finished products<br>made from fabrics and similar<br>materials | 69 | 21 | 210 |
| 83 | Social services   | 69 | 21 | 45  |
| 82 | Educational services  | 68 | 21 | 378 |
| 51 | Wholesale trade nondurable goods  | 68 | 20 | 65  |

TABLE E-5 (Cont'd)

|    |  |    |    |     |
|----|--|----|----|-----|
| 27 | Printing, publishing, and allied industries                                | 68 | 27 | 101 |
| 73 | Business services  | 68 | 21 | 282 |
| 25 | Furniture and fixtures   | 67 | 17 | 55  |
| 22 | Textile mill products  | 66 | 30 | 88  |
| 49 | Electric gas and sanitary services   | 66 | 19 | 35  |
| 80 | Health services  | 65 | 19 | 363 |
| 58 | Eating and drinking places   | 65 | 23 | 439 |
| 41 | Local and suburban transit and interurban highway passenger transportation | 65 | 33 | 54  |
| 53 | General merchandise stores   | 65 | 31 | 196 |
| 13 | Oil and gas extraction   | 63 | 7  | 35  |
| 75 | Automotive repair services and garages                                     | 63 | 15 | 33  |
| 63 | Insurance  | 62 | 26 | 84  |
| 79 | Amusement and recreation services, except motion pictures                  | 62 | 14 | 88  |
| 1  | Agriculture, forestry, and fishing   | 61 | 21 | 468 |
| 48 | Communication  | 60 | 16 | 48  |
| 78 | Motion pictures  | 58 | 7  | 34  |
| 30 | Rubber and miscellaneous plastics products                                 | 54 | 13 | 51  |
| 44 | Water transportation   | 50 | 11 | 41  |

TABLE E-6

INDUSTRY TRANSITION

Older Industries in 1957 and 1975

Furniture Stores  
Paper Products  
Building Construction  
Real Estate  
Miscellaneous Manufacturing  
Chemicals  
Membership Organizations  
Measuring, Analyzing, and Controlling Instruments  
Stone, Clay, and Glass Products

Median Industries 1957/Older Industries 1975

Leather Products  
Machinery  
Miscellaneous Services  
Motor Freight Transport  
Transportation Equipment

Median Industries 1957 and 1975

Hotels and Rooming Houses  
Special Trade Construction  
Wholesale Trade (Durable)  
Furniture and Fixtures  
Food Stores  
Wholesale Trade (Nondurable)

Median Industries 1957/Younger Industries 1975

Eating and Drinking Places

Younger Industries 1957 and 1975

Insurance  
Communication  
General Merchandise Stores  
Health Services  
Rubber and Plastic Products  
Automotive Repair  
Oil and Gas Extraction



TABLE E-6 (Cont'd)

Younger Industries 1957/Older Industries 1975

Lumber and Wood Products  
Private Households  
Personal Services  
Gas Service Stations

Older Industries 1957/Median Industries 1975

Printing, Publishing  
Electric, Gas, and Sanitary Services  
Fabricated Metal  
Textile Mill Products

Older Industries 1957/Younger Industries 1975

Motion Pictures  
Local Transport  
Amusement and Recreation  
Water Transportation

Younger Industries 1957/Median Industries 1975

Food and Kindred Products  
Business Services  
Banking  
Miscellaneous Retail  
Social Services  
Electrical Machinery  
Educational Services

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